

# **AS-AD, IS-LM-PC Model**

7ed: Ch.9

6ed: Ch.7

# 목차

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  - 6ed Ch.7
- IS-LM-PC model
  - 7ed Ch.9

# **AS-AD Model**

6ed, Ch.7

# AS-AD 모형

- 단기와 중기의 관계를 분석하기 위한 모형
  - 세로축:  $P$  (Price Index)
  - 가로축:  $Y$  (real GDP)
- 총공급 (Aggregated Supply, AS)
  - 임금 - 가격 설정식으로부터 도출 (실물 공급측)
- 총수요 (Aggregated Demand, AD)
  - IS-LM 균형으로부터 도출 (실물 수요측)

# Aggregate Supply (AS)

- $P - Y$  평면에 구성해야 함
  - 나머지 파라미터들은 주어진 값이 될 것
- Wage, Price 결정식으로부터 출발
- $u$ 를  $Y$ 로 변환해야 함.
  - $u := U/L$ 에서 시작
  - $u$ : 실업"률"
  - $U$ : 실업자의 수
  - $L$ : 경제활동인구의 수 =  $U+N$
  - $N$ : 취업자의 수
  - 생산함수:  $Y = AN = 1 \times N$

$$W = P^e F(u, z)$$

$$P = (1 + m)W$$

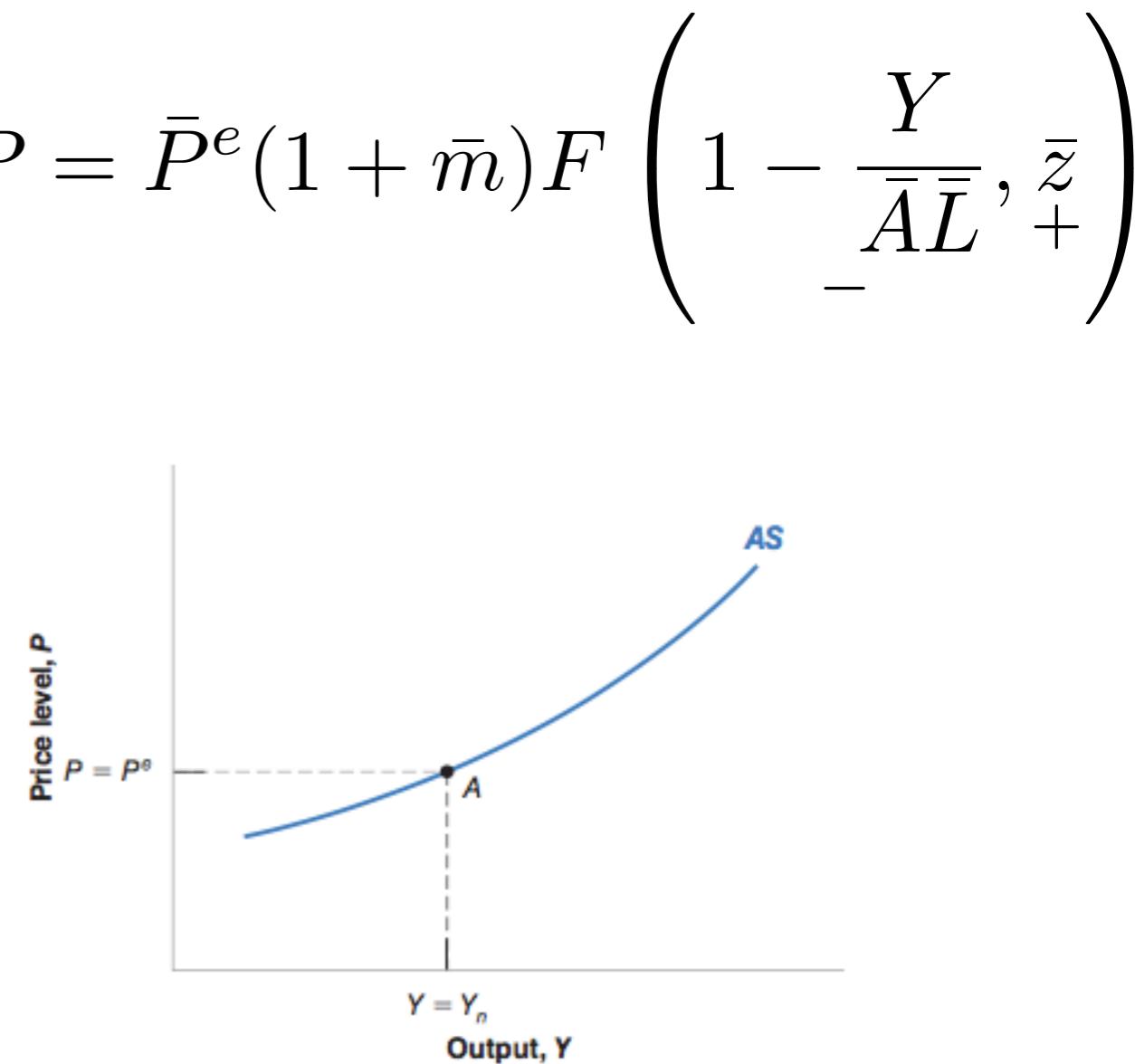
$$Y = \bar{A}N, \quad L \equiv U + N$$

$$u \equiv \frac{U}{L} = \frac{L - N}{L} = 1 - \frac{N}{L} = 1 - \frac{Y}{\bar{A}L}$$

$$P = \bar{P}^e (1 + \bar{m}) F \left( 1 - \frac{Y}{\bar{A}\bar{L}}, \bar{z} \right)$$

# AS Curve

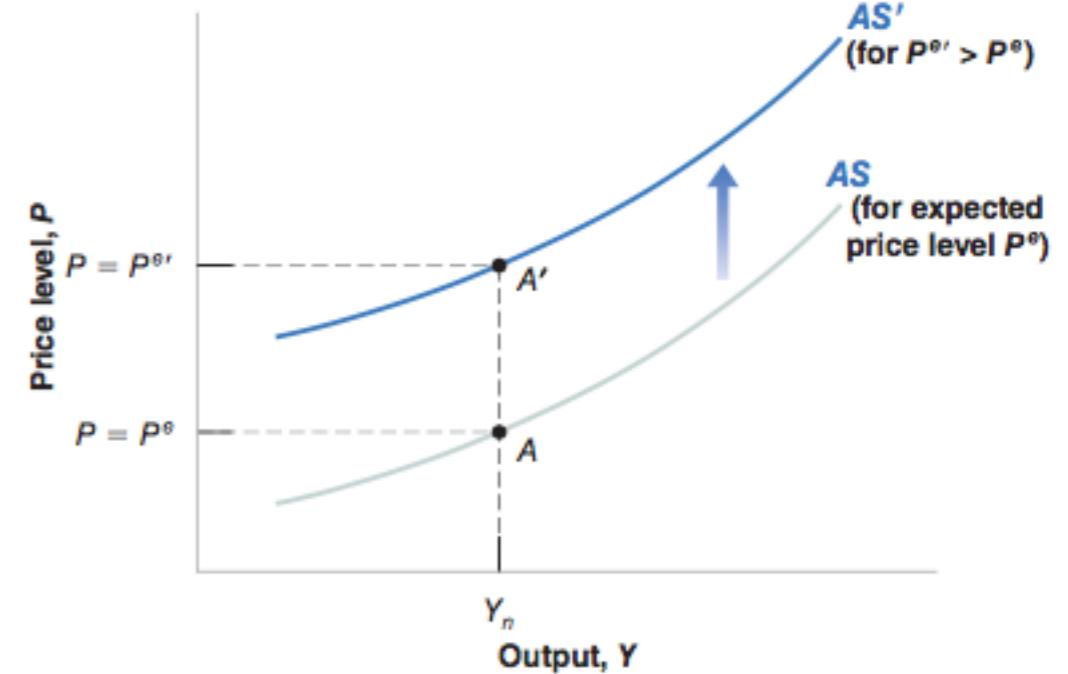
- $P$ 와  $Y$ 는 Positive relation
  - $Y \uparrow \Rightarrow N \uparrow \Rightarrow U \downarrow \Rightarrow P = \bar{P}^e(1 + \bar{m})F \left( 1 - \frac{Y}{\bar{A}\bar{L}}, \bar{z} \right)$
  - $U \downarrow \Rightarrow W \uparrow \Rightarrow P \uparrow$
- $P^e$ 와  $P$ 는 비례
  - 다른 변수들이 변동 없을 경우를 전제
- $u = u_n$  일 때의  $Y = Y_n$  이라고 “정의” (잠재총생산, Potential GDP)
  - $Y = Y_n$  일 경우  $P = P^e$
  - 필립스곡선이 장기적으로 이동하지 않는 상태



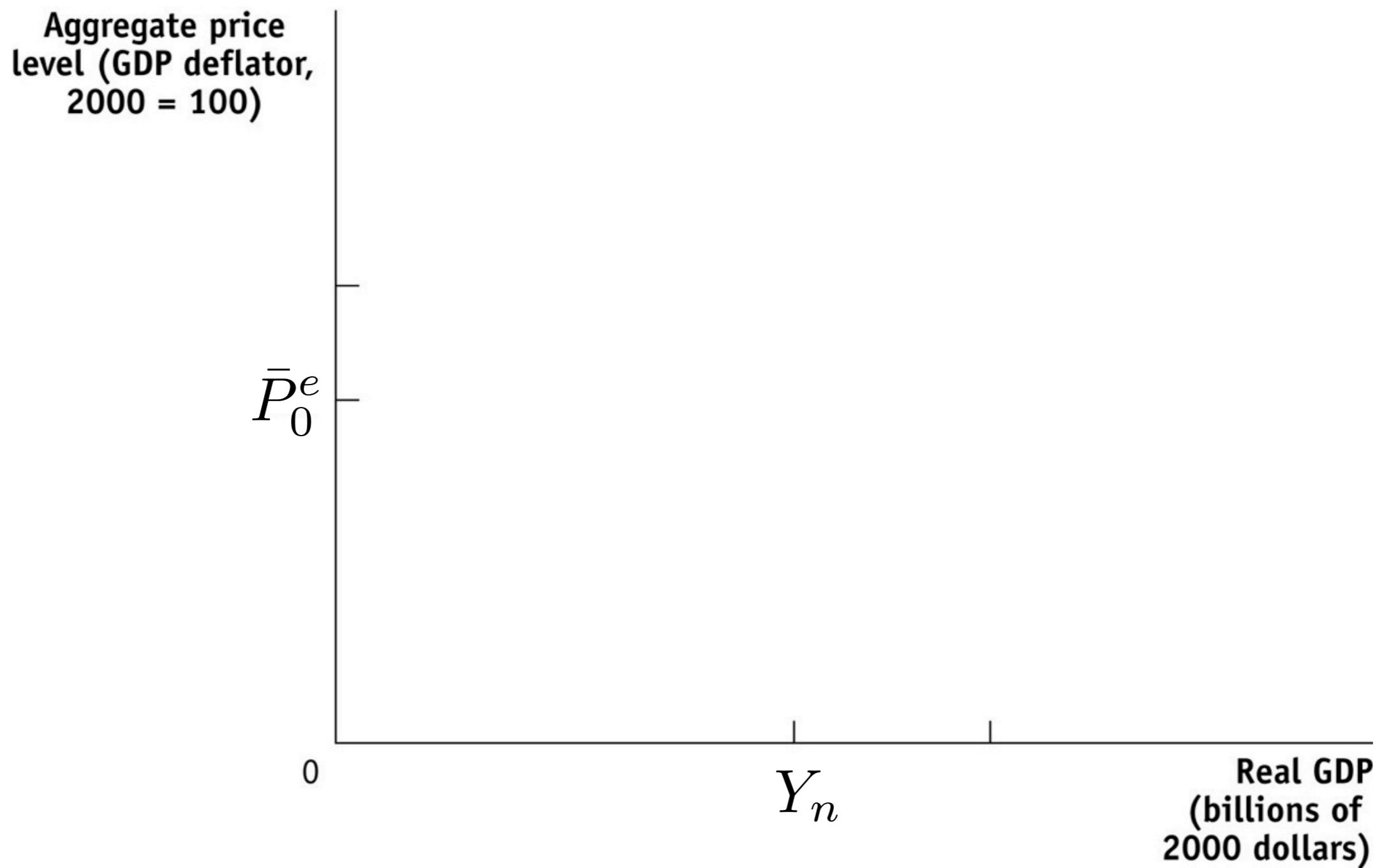
# AS 곡선의 이동

- 주의: 미언급한 변수는 특별한 언급 없는 한 고정으로 가정할 것.
- $P^e$  증가  $\Rightarrow$  AS up shift
- 기업 독점력 증가  $\Rightarrow$  AS up shift
- 총생산 증가  $\Rightarrow$  AS NO shift (증기)
  - $Y_n$  상태였다면
  - 장기:  $Y \uparrow \Rightarrow P > P^e \Rightarrow P^e \uparrow \Rightarrow$  AS up shift
- 노동 생산성 증가 ( $Y$  불변,  $A \uparrow$ )  $\Rightarrow$  AS down shift
  - 참고: 원료비, 실물자본 생산성 변동은 좀 더 복잡한 모형으로 다름.

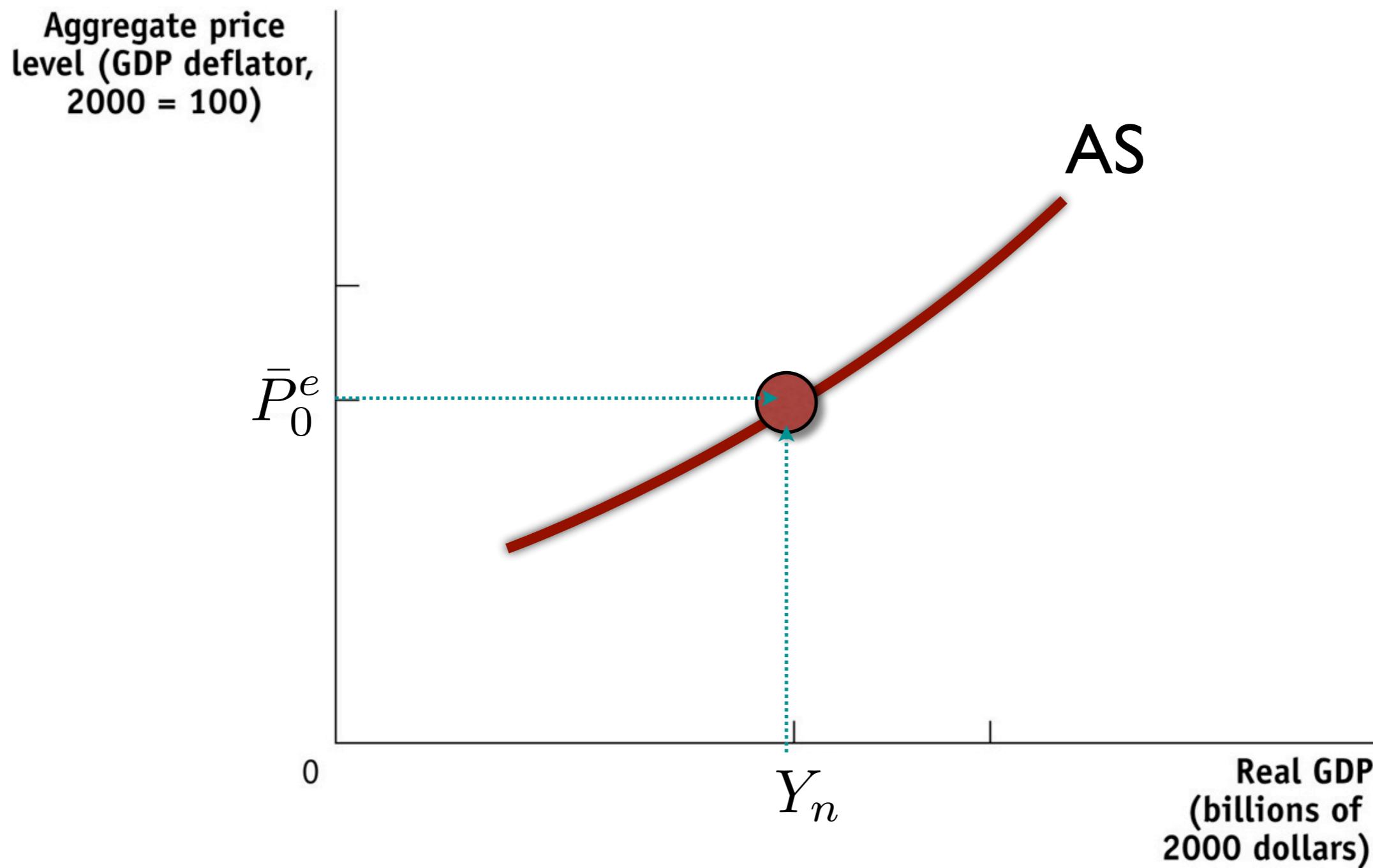
$$P = \bar{P}^e (1 + \bar{m}) F \left( 1 - \frac{Y}{\bar{A} \bar{L}}, \bar{z} \right)$$



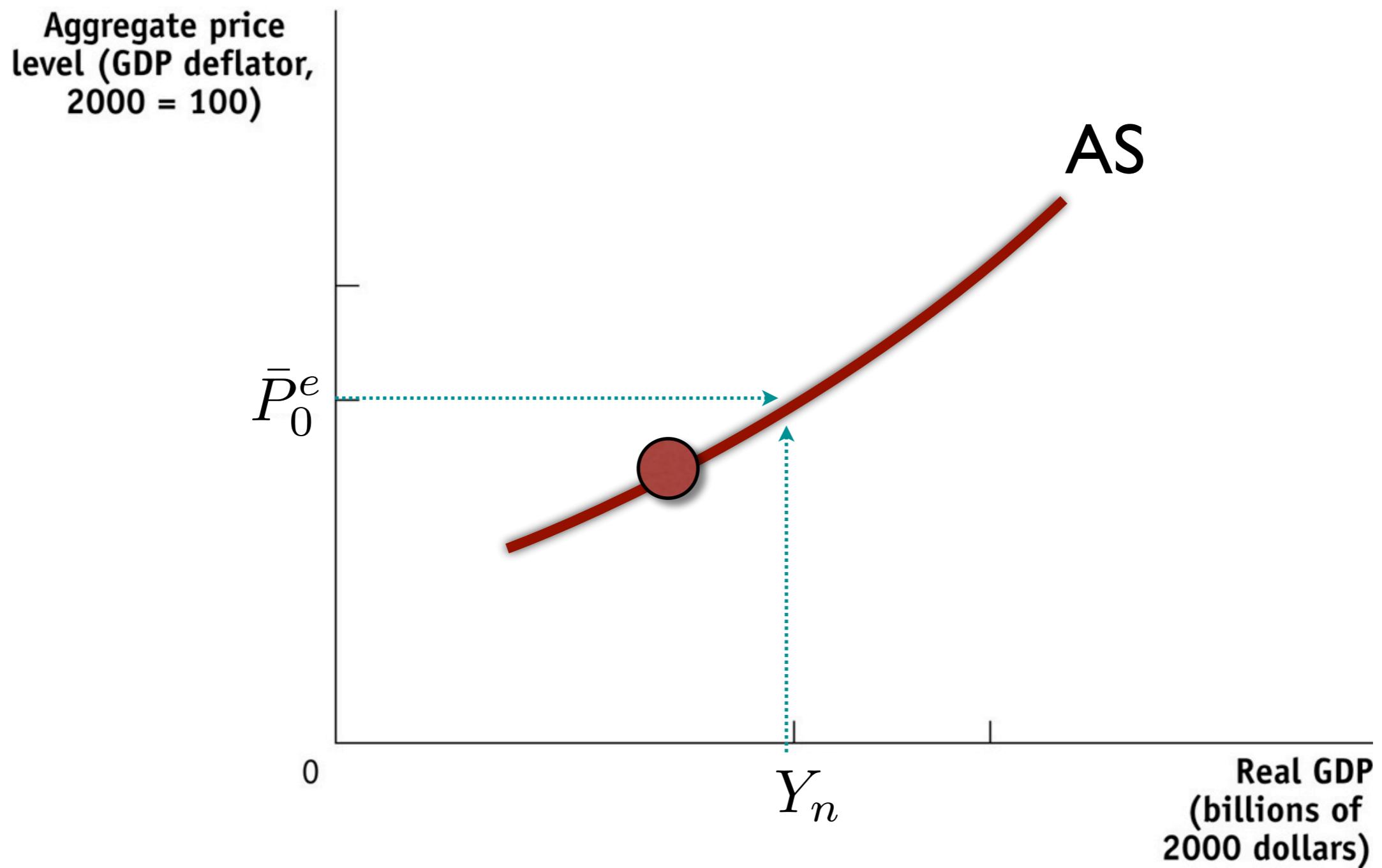
# 곡선상에서의 이동: 예) 경기중립 $\Rightarrow$ 불경기



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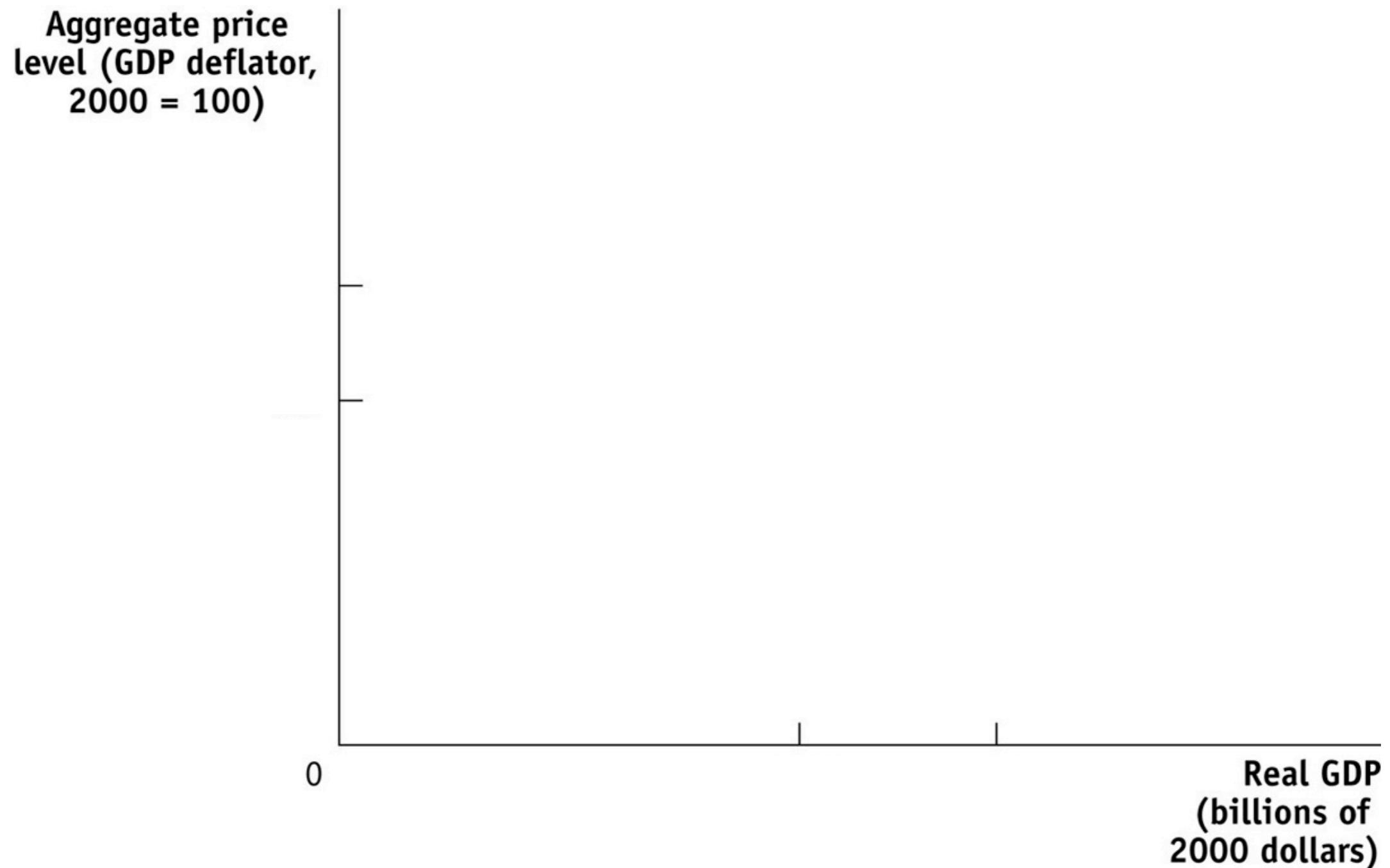


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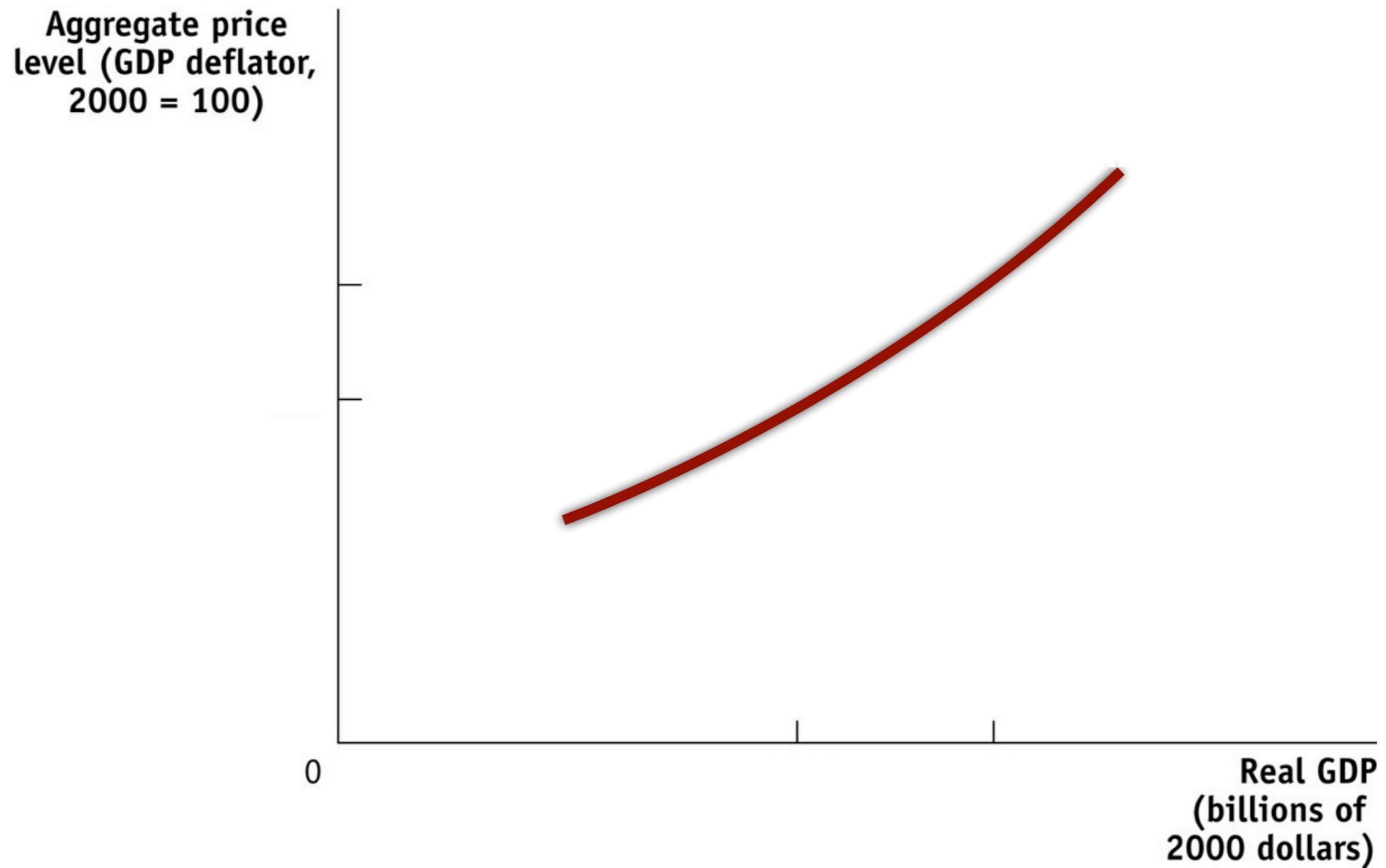
# Movement of AS itself

## Ex: Labor Productivity ↑



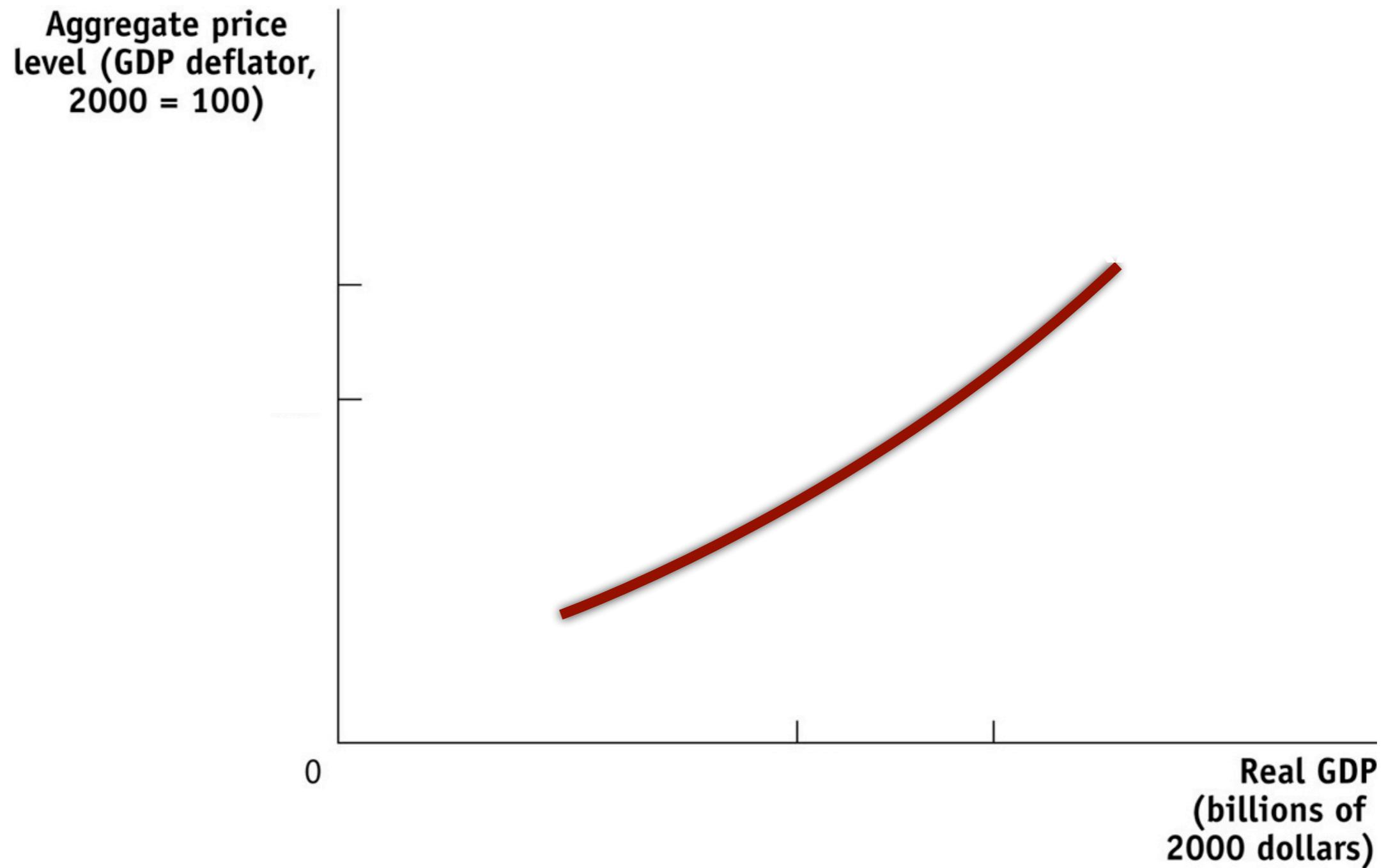
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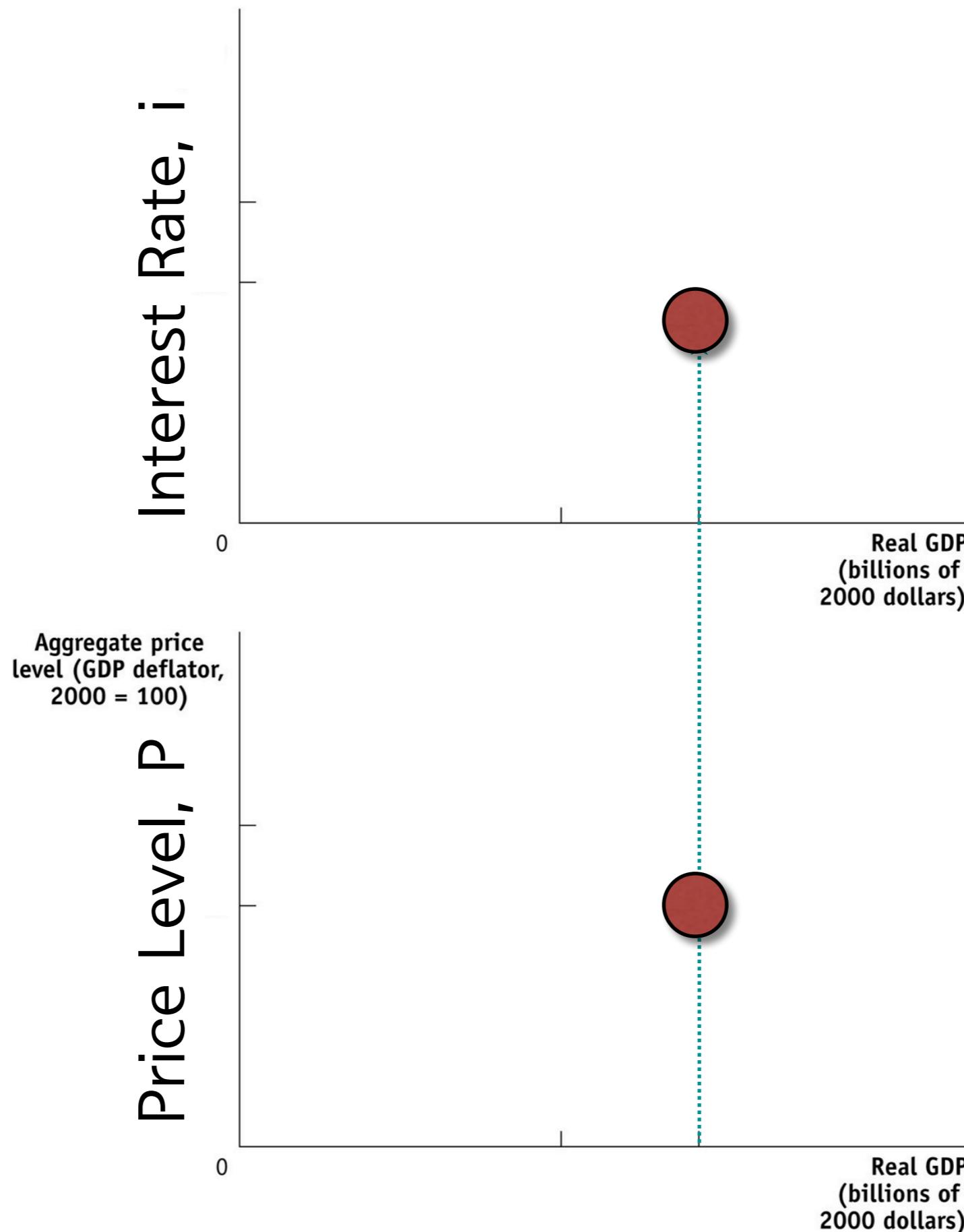


# Aggregate Demand (AD)

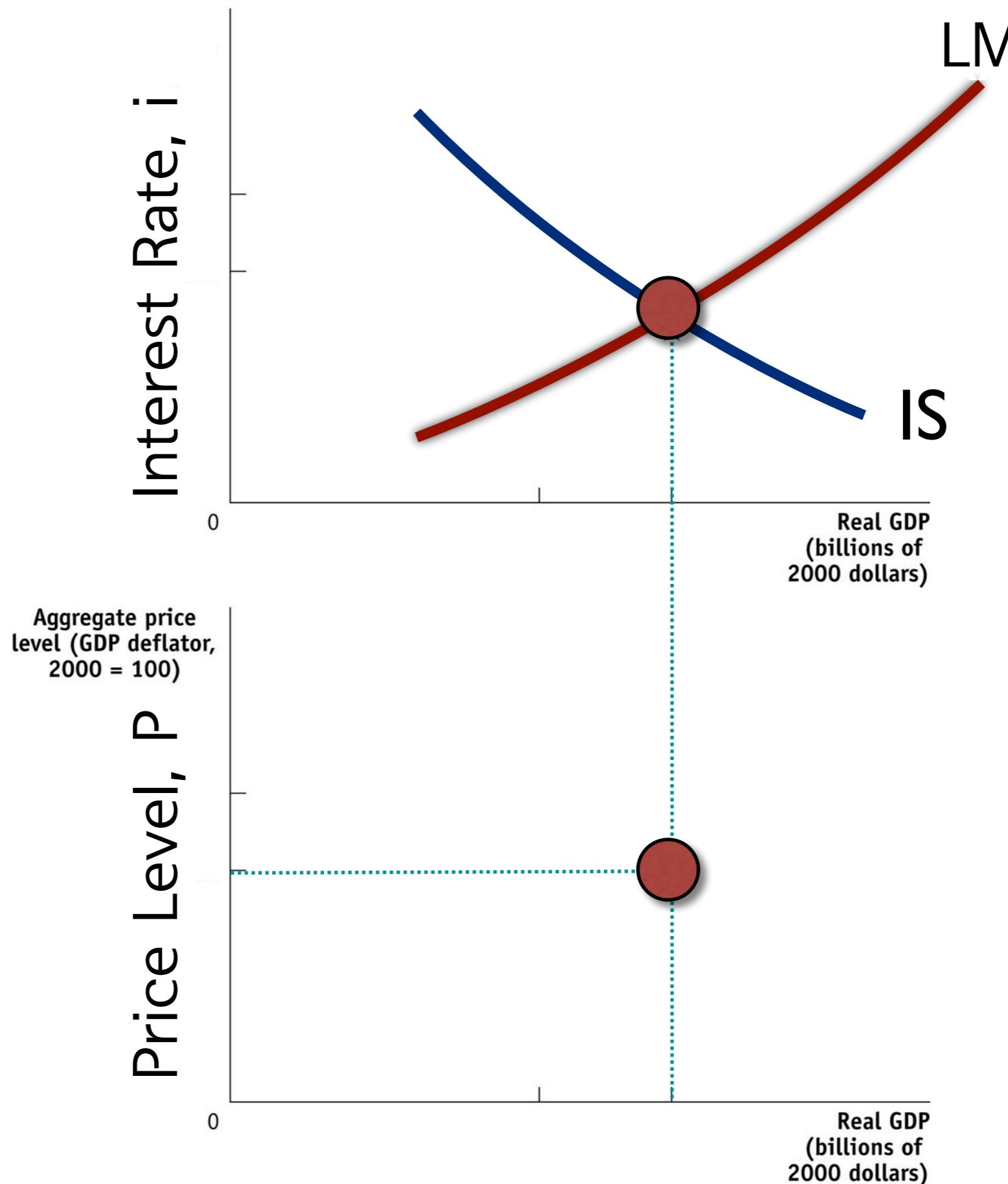
$$\underbrace{Y}_{\text{Production}} = \underbrace{C(Y - T) + I(Y, i)}_{\text{Demand for goods}} + G$$
$$\frac{M_d}{\bar{P}} = YL(i) \quad \text{or} \quad i = \tilde{i}$$

- IS-LM 모형으로부터 도출
  - 6판:  $i$ 가 아닌,  $M_d$  가 정책변수 - 우상향하는 LM 곡선
  - 7판:  $M_d$ 가 아닌,  $i$ 가 정책변수 - 수평의 LM곡선
- AD 곡선을 도출하기 위해서는 이 연립방정식을  $P$ ,  $Y$ 의 관계로 바꿔야 함.

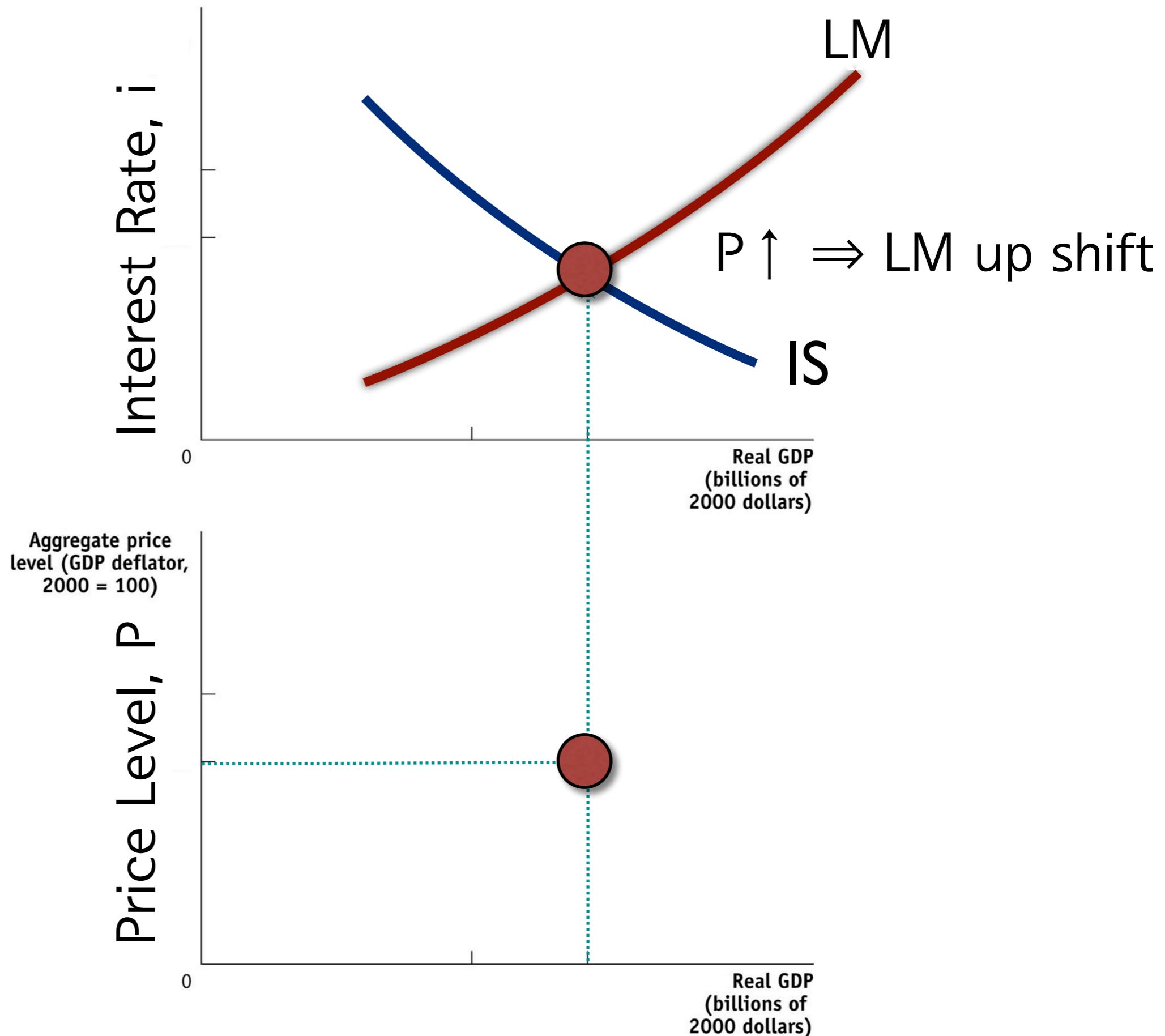
# AD 곡선의 유도: 6판



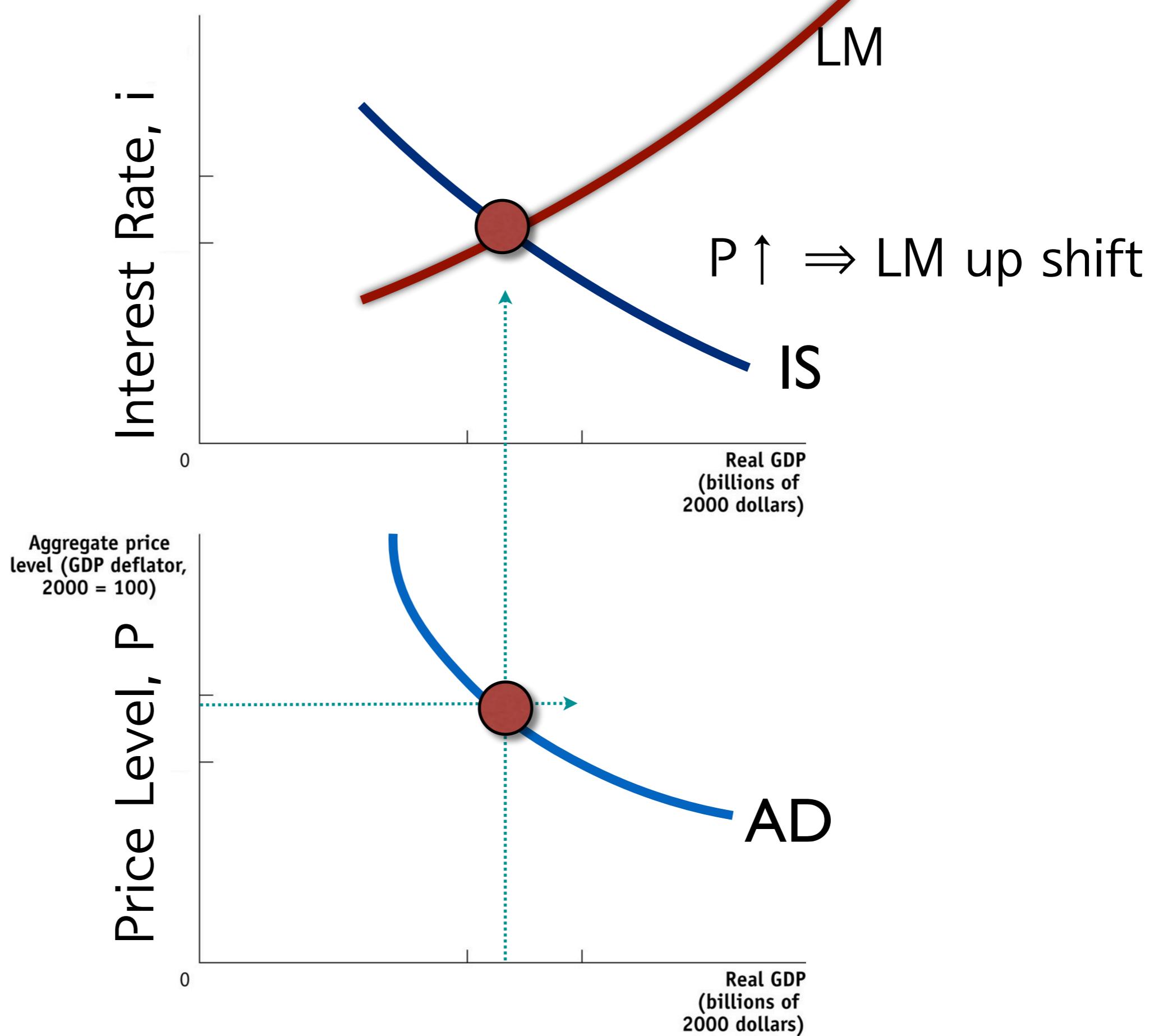
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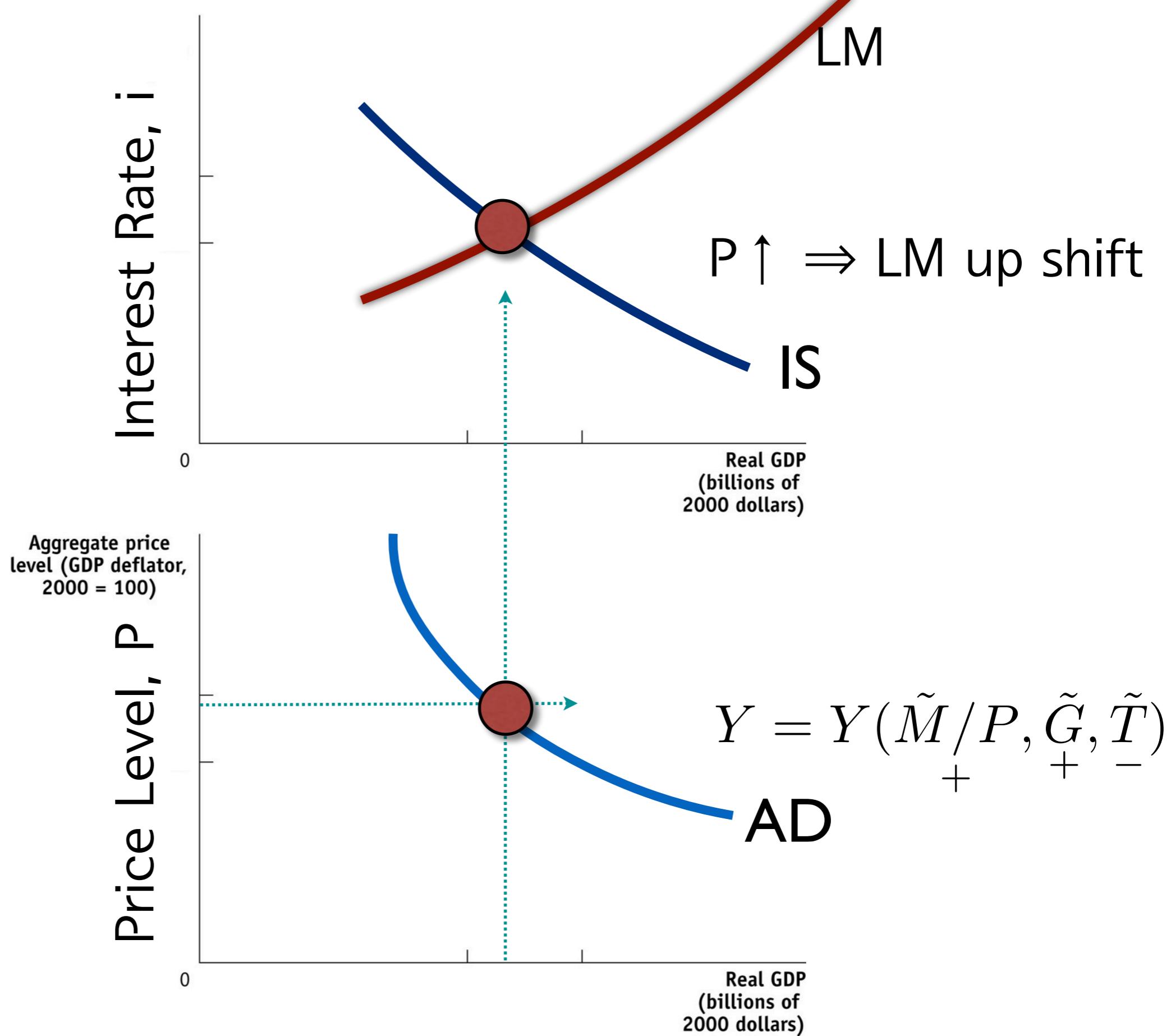
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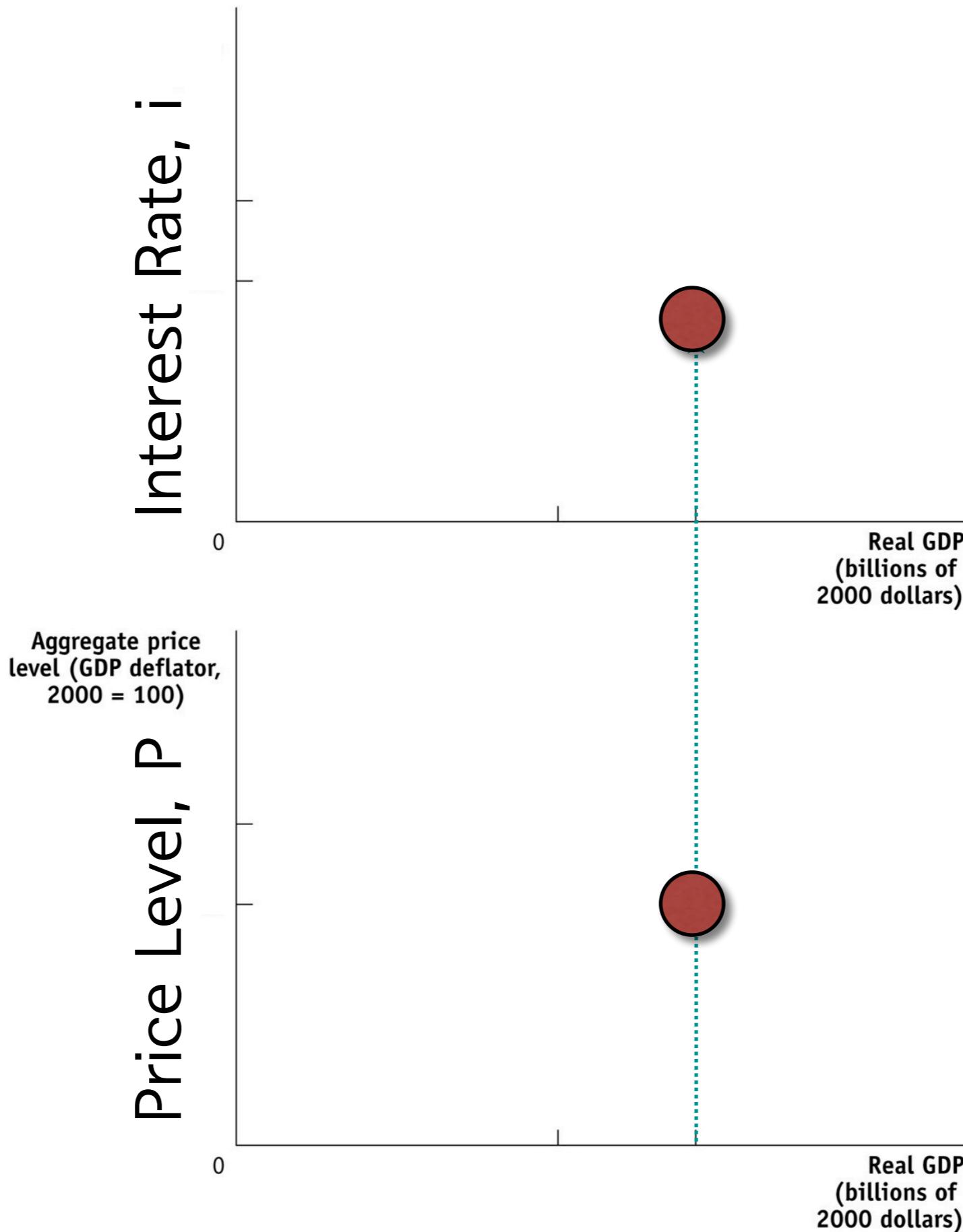
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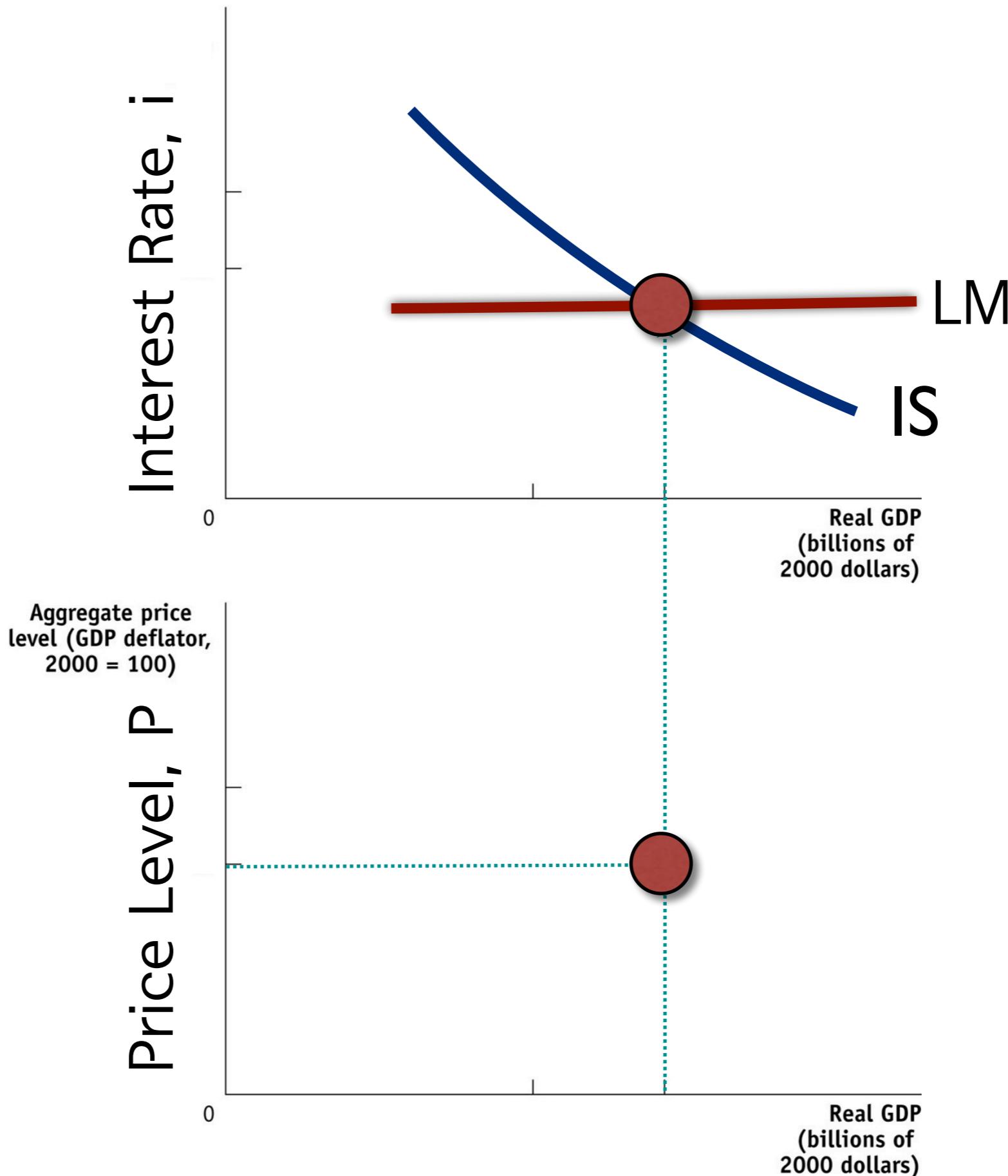
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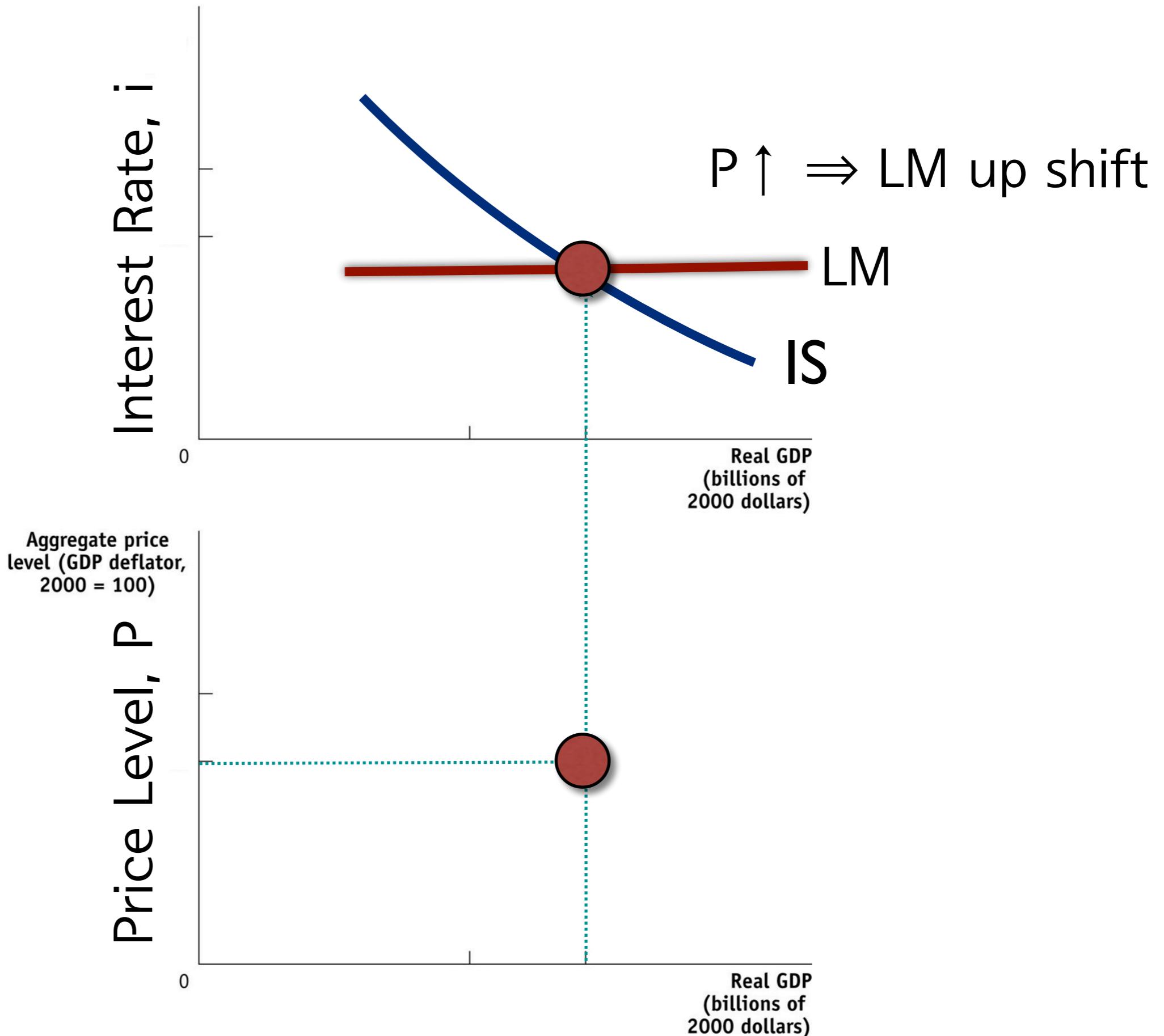
# AD곡선의 유도: 7판



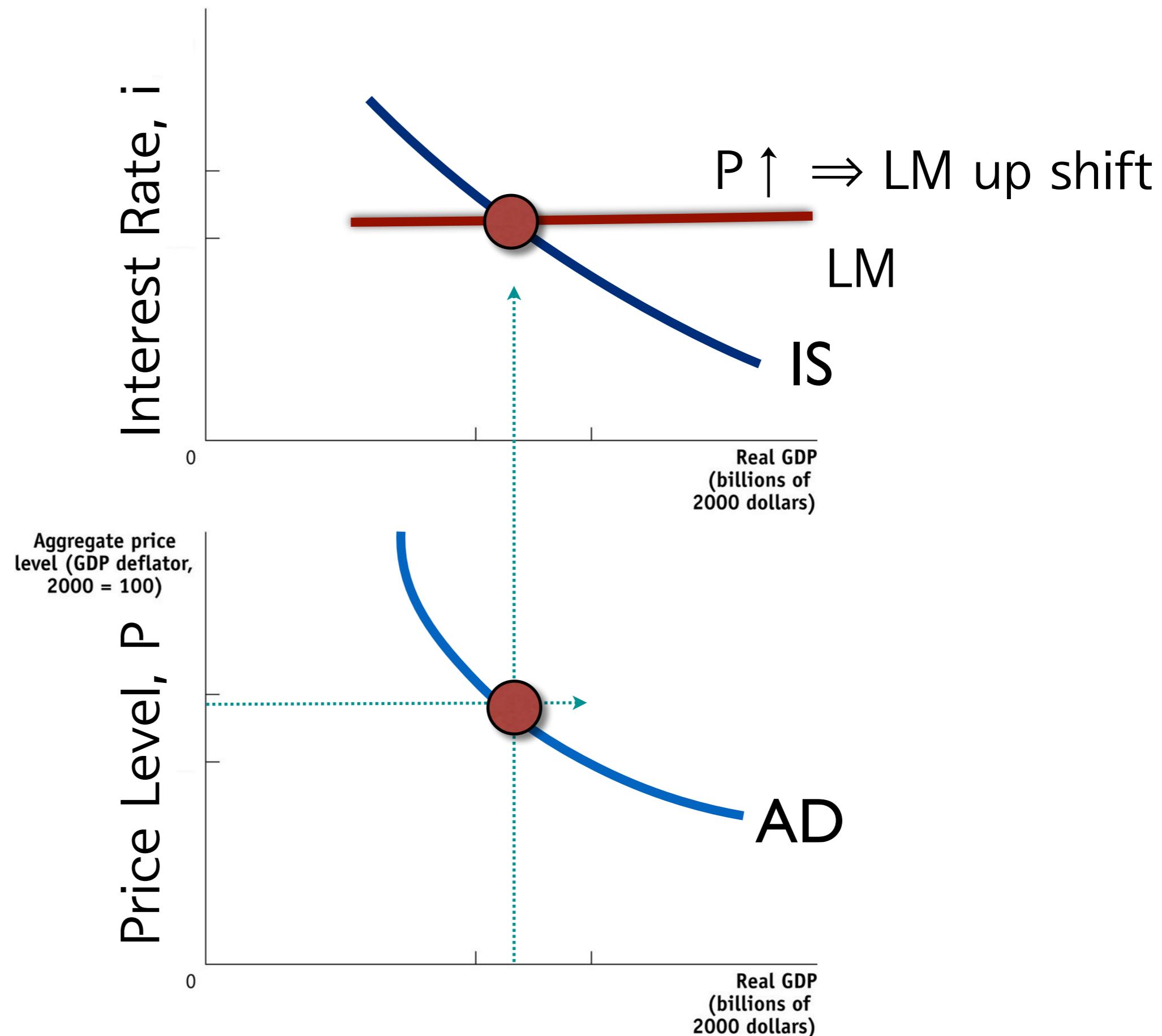
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# AD 곡선의 이동

$$Y = Y(\tilde{M}/P, \underset{+}{\tilde{G}}, \underset{-}{\tilde{T}})$$

- 확장 재정정책( $\Delta G > 0$ ): AD right shift
- 긴축 통화정책( $\Delta M < 0$ ): AD left shift

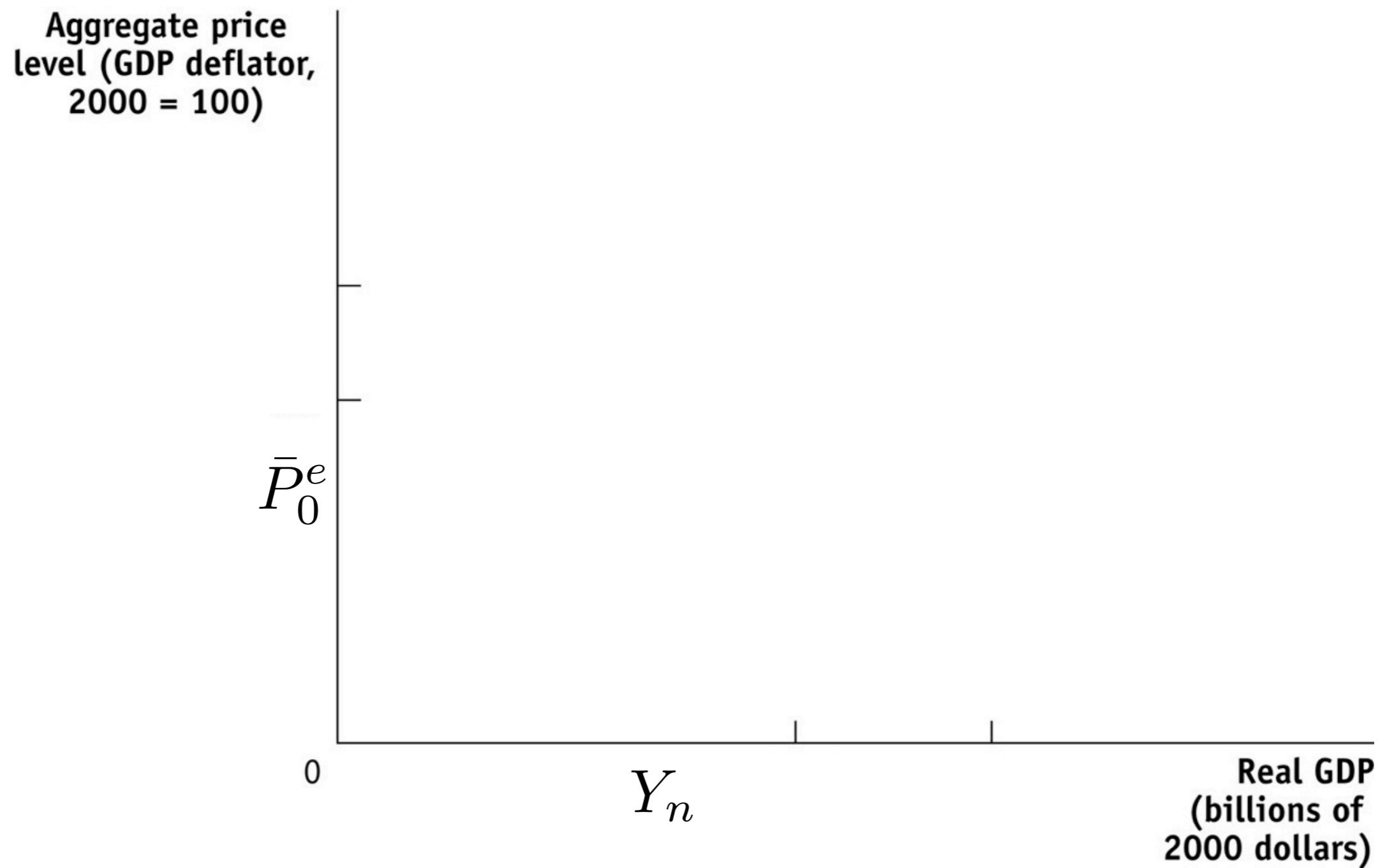
# 종합: 단기/중기 균형

$$P = \bar{P}^e(1 + \bar{m})F\left(1 - \frac{Y}{\bar{A}\bar{L}}, \bar{z}_+\right)$$

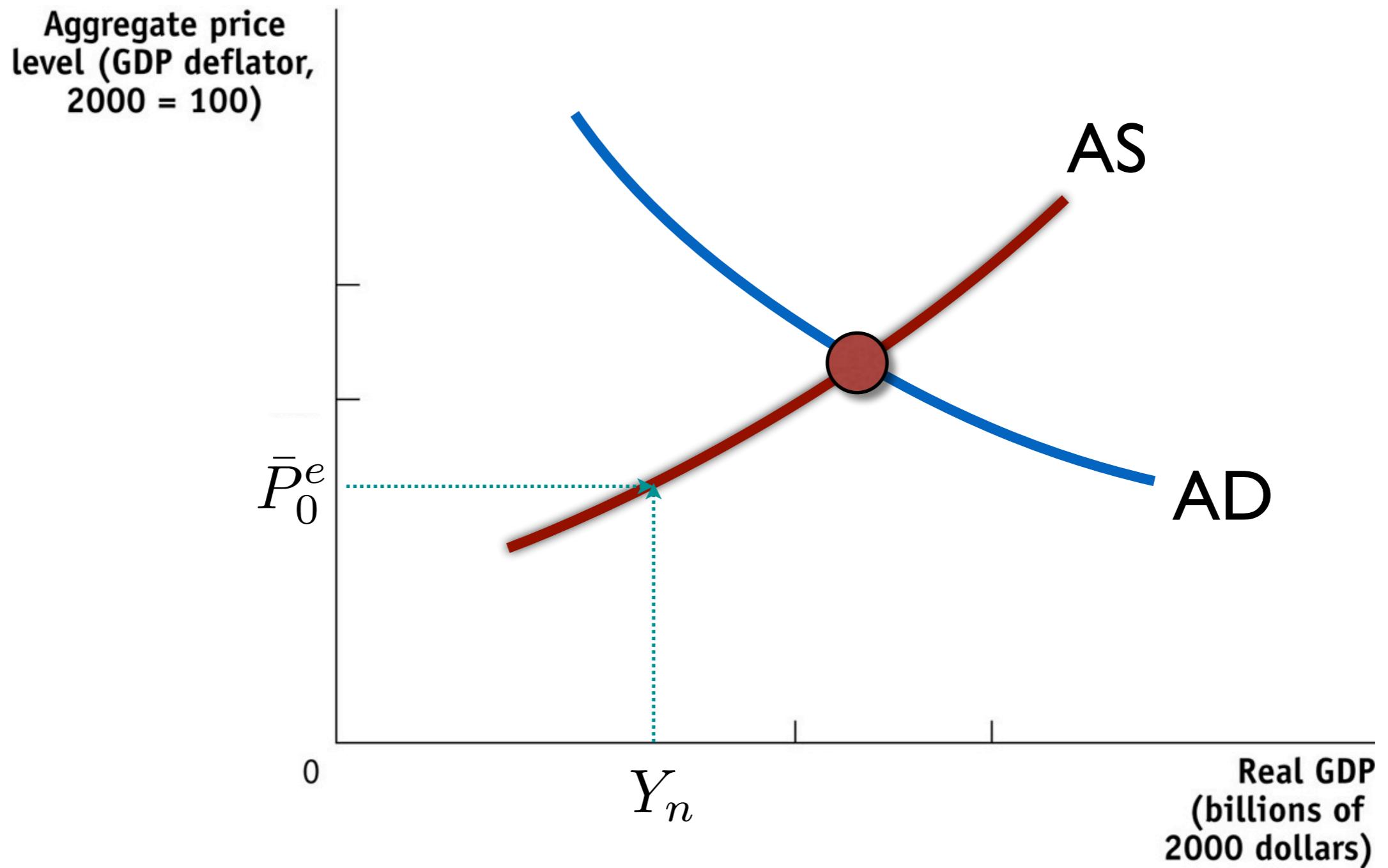
$$Y = Y(\tilde{M}/P, \tilde{G}_+, \tilde{T}_-)$$

- 단기:  $P^e$  불변  $\Rightarrow$  교차점의  $P, Y$ 가 균형점.
- 중기:  $P^e$  변동  $\Rightarrow Y=Y_n$ 
  - 지속적으로  $P$ 와  $P^e$ 가 불일치하면 사람들은  $P^e$ 를 수정  
 $\Rightarrow$  추가 AS shift 발생 ( $Y=Y_n$  이 되는 방향)
    - $Y > Y_n \Rightarrow P^e \uparrow$
    - $Y < Y_n \Rightarrow P^e \downarrow$

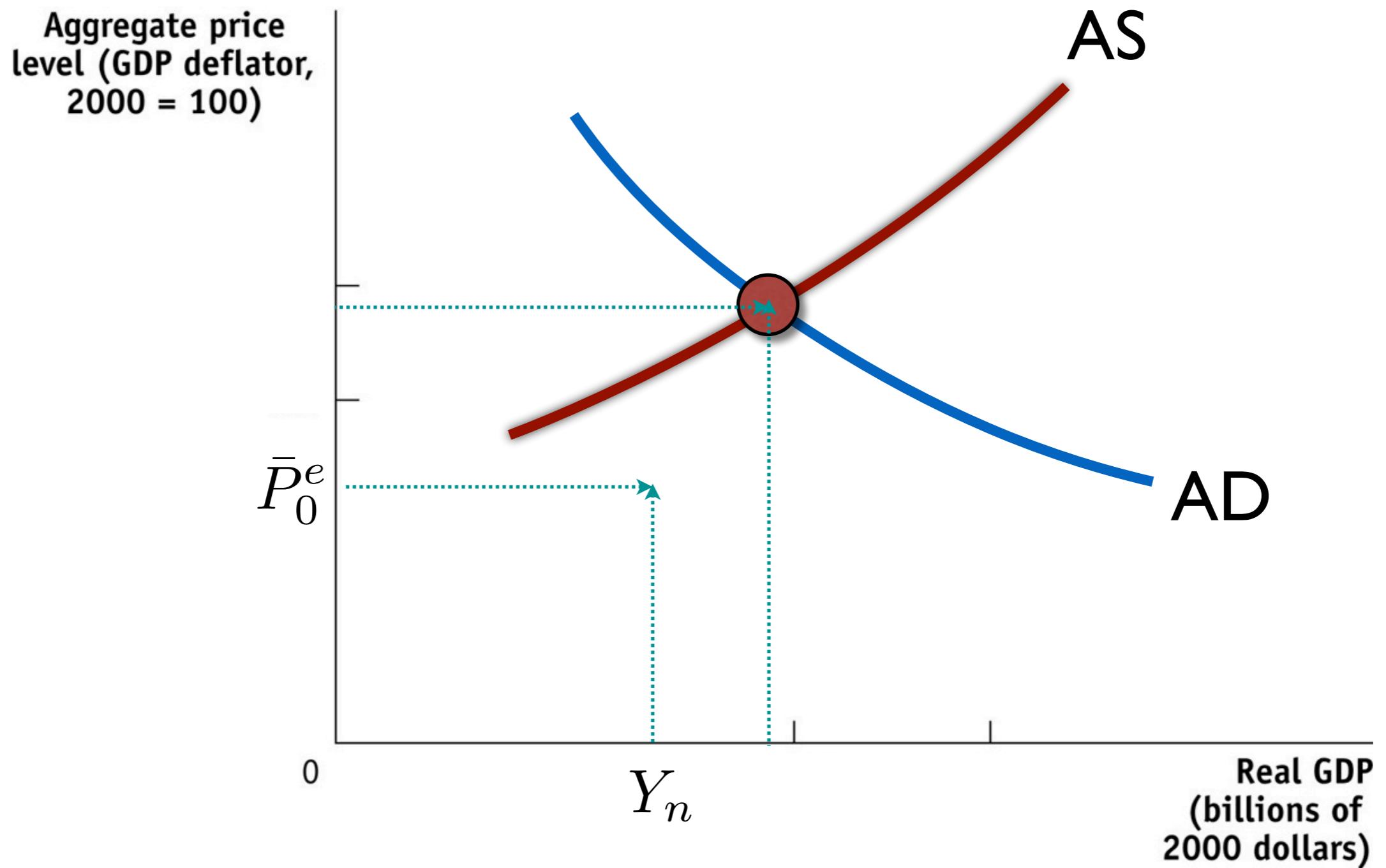
# AS shock (단기-중기): case1



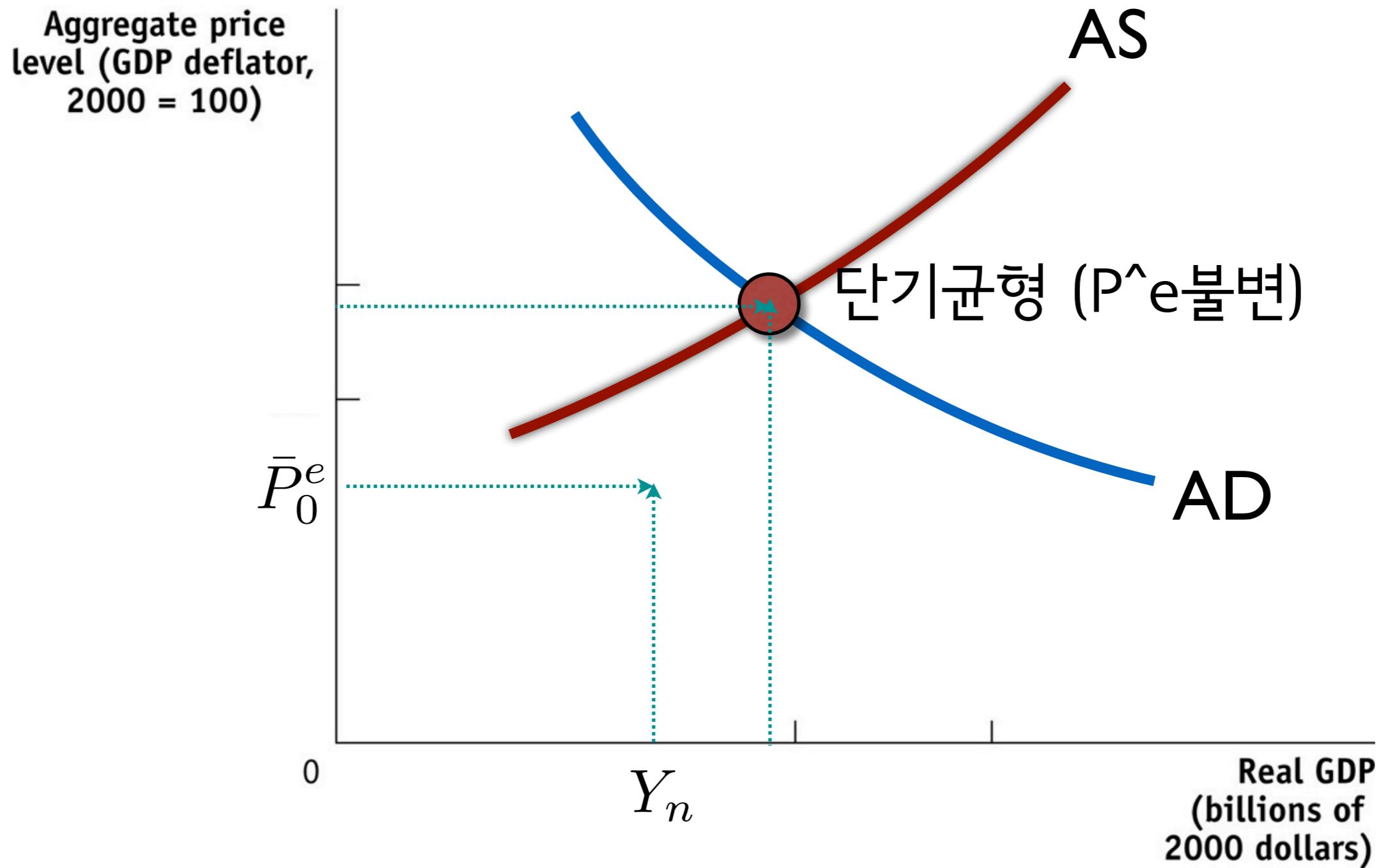
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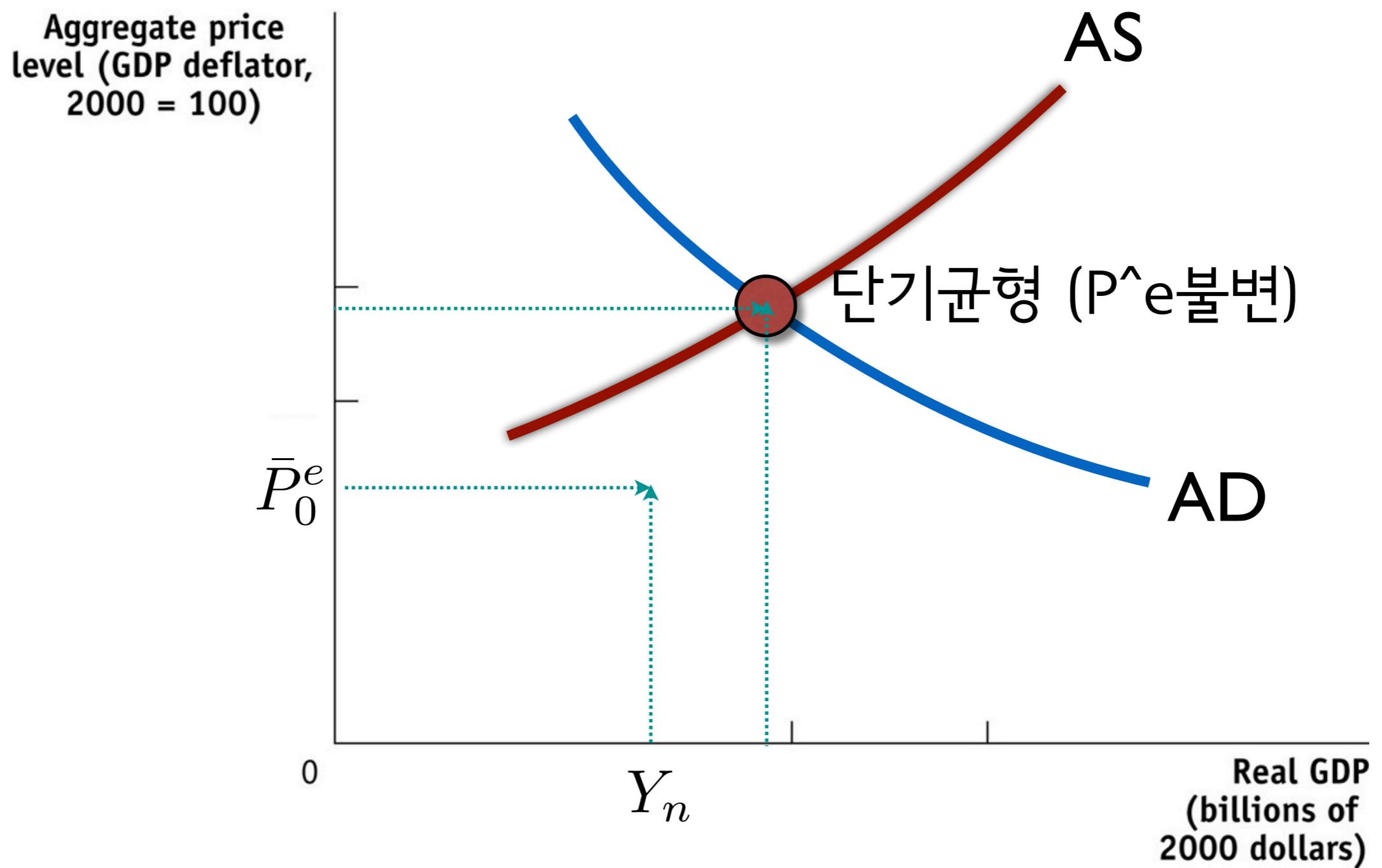


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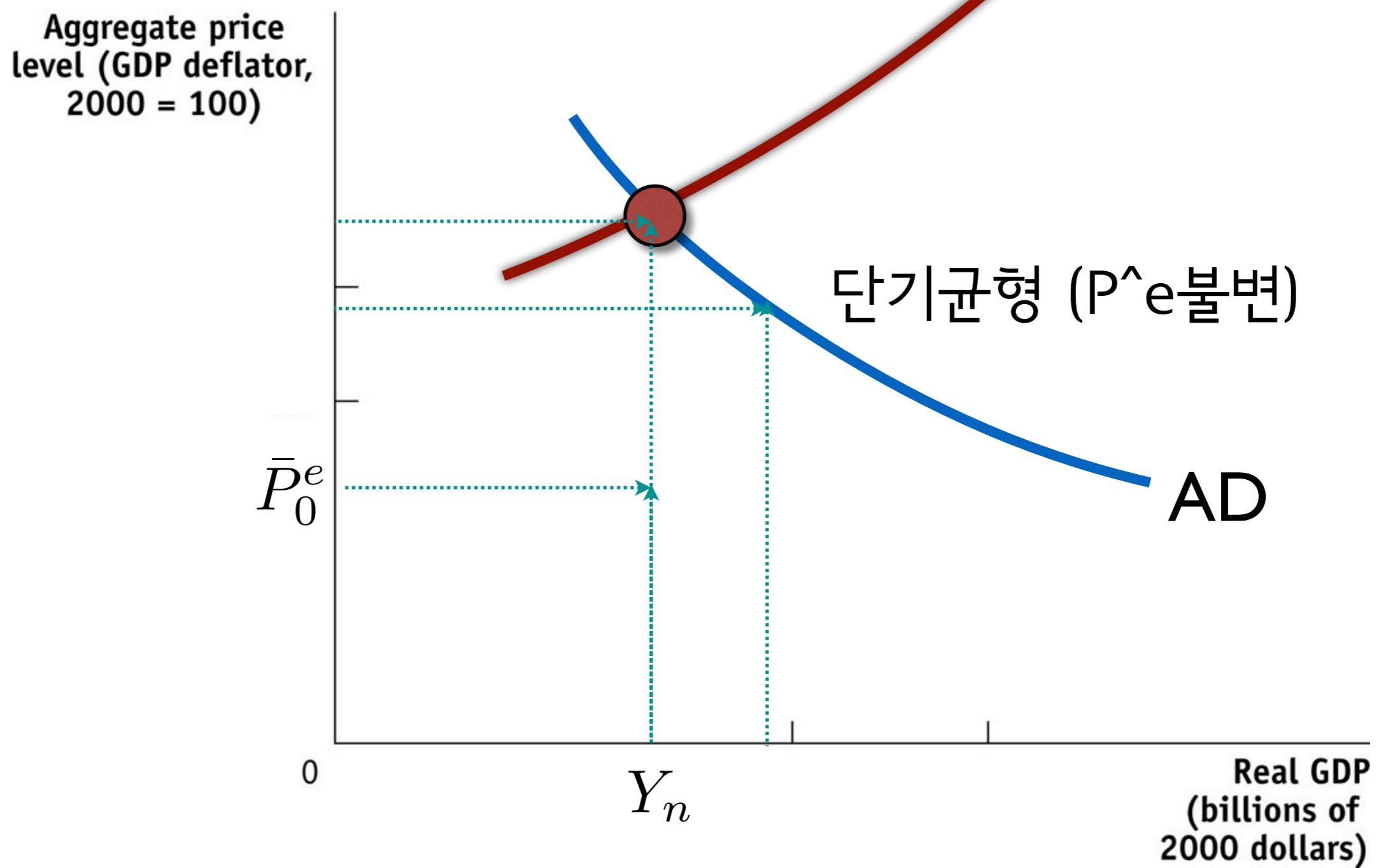
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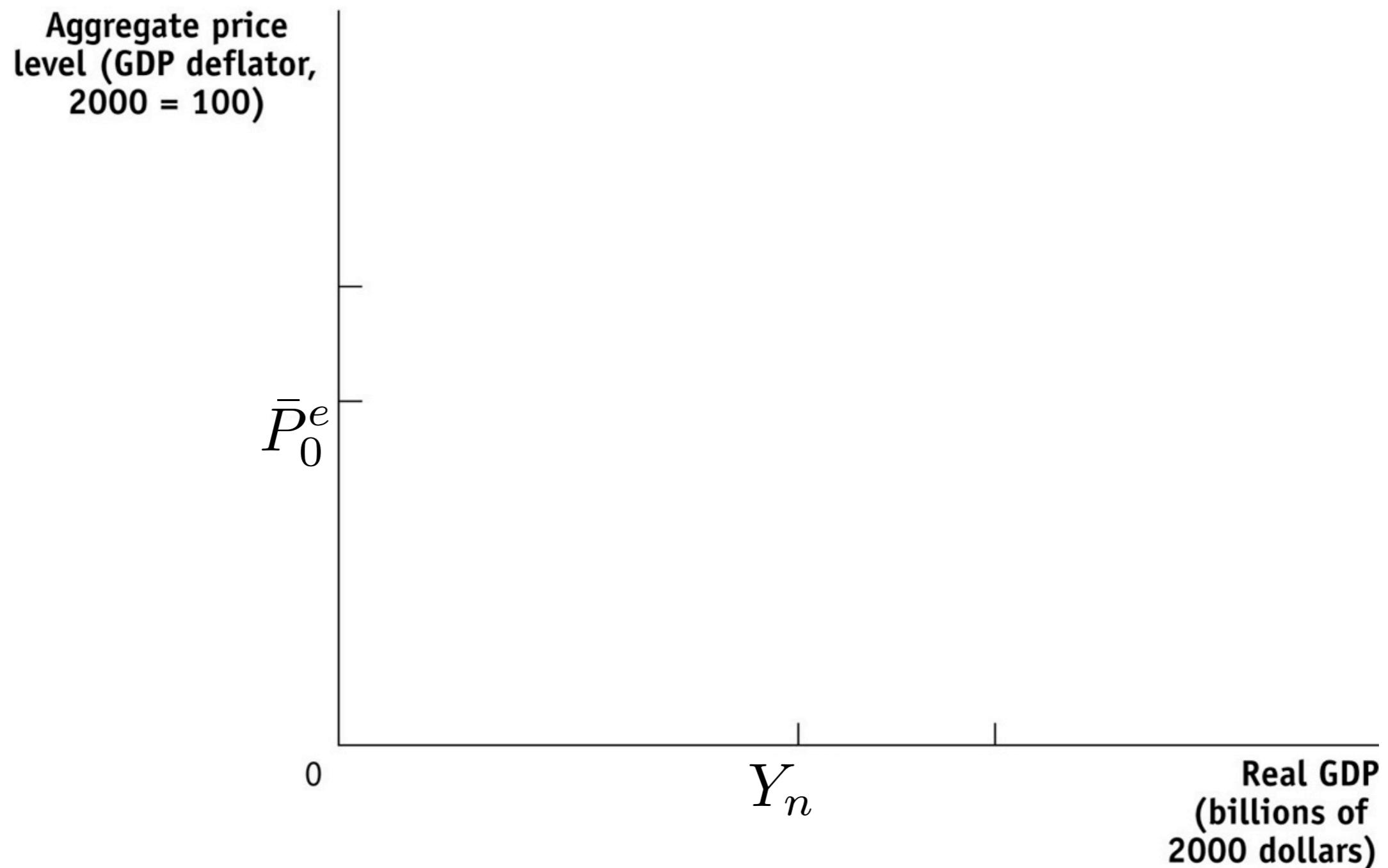


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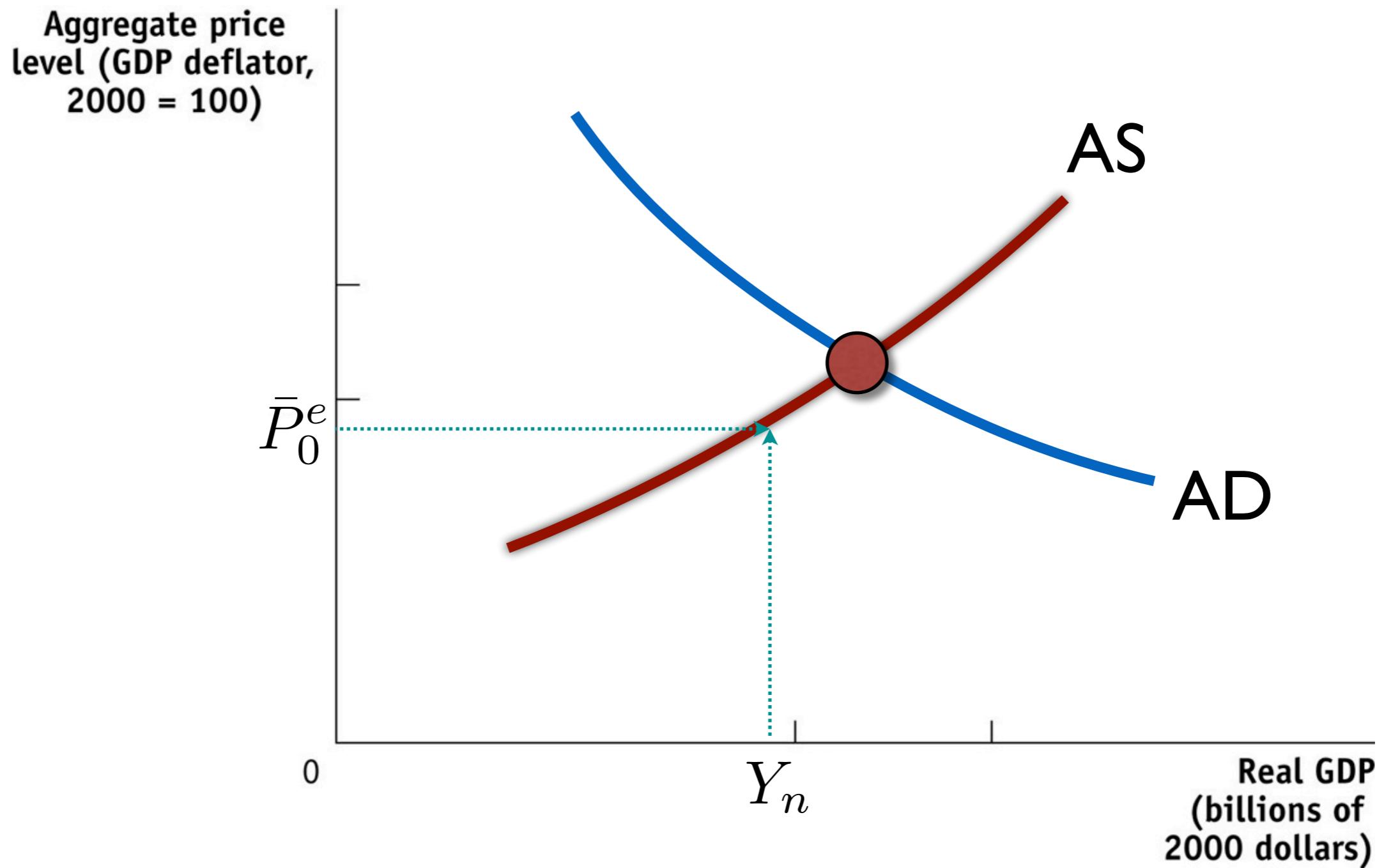
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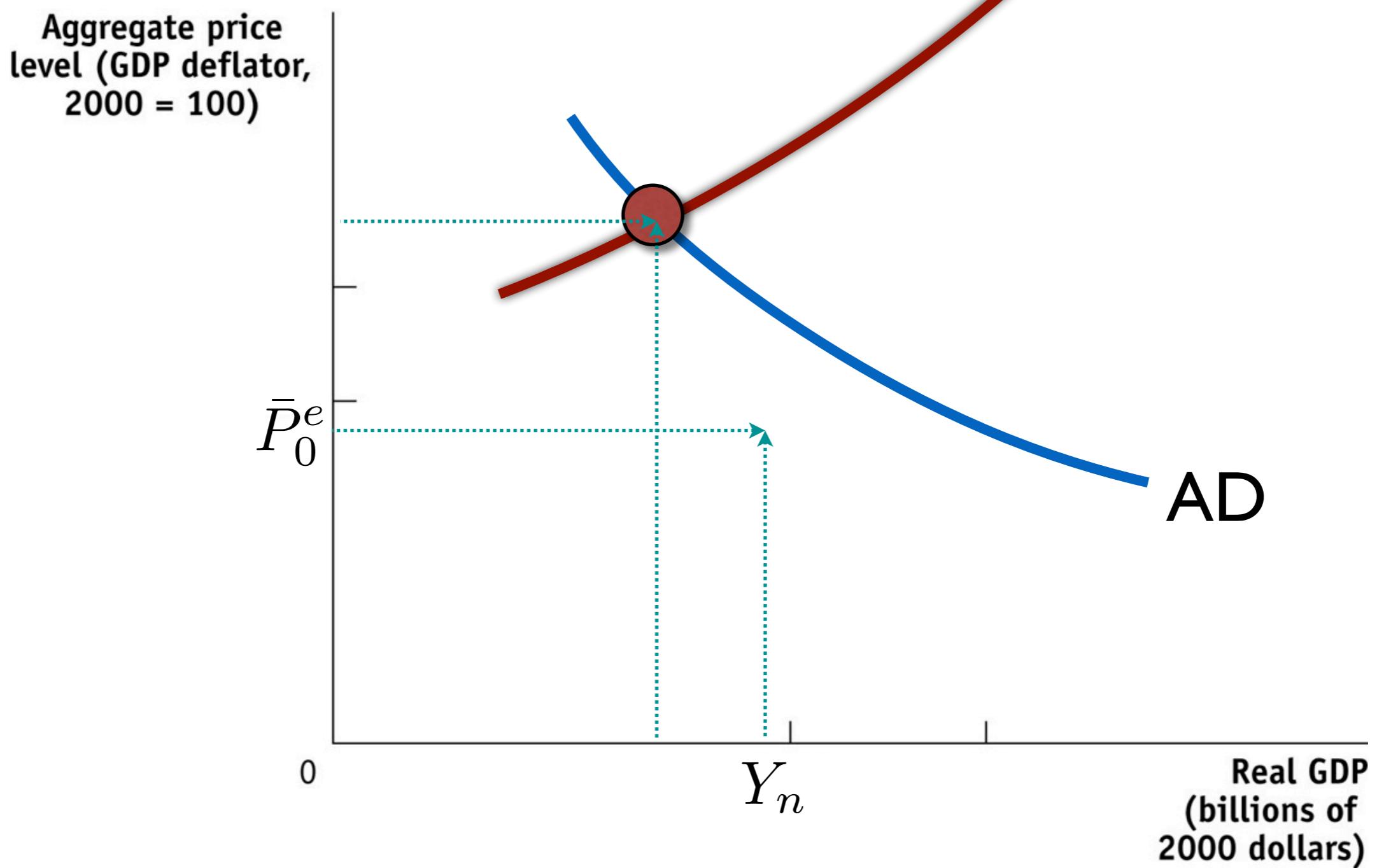
# AS shock (단기-중기): case2



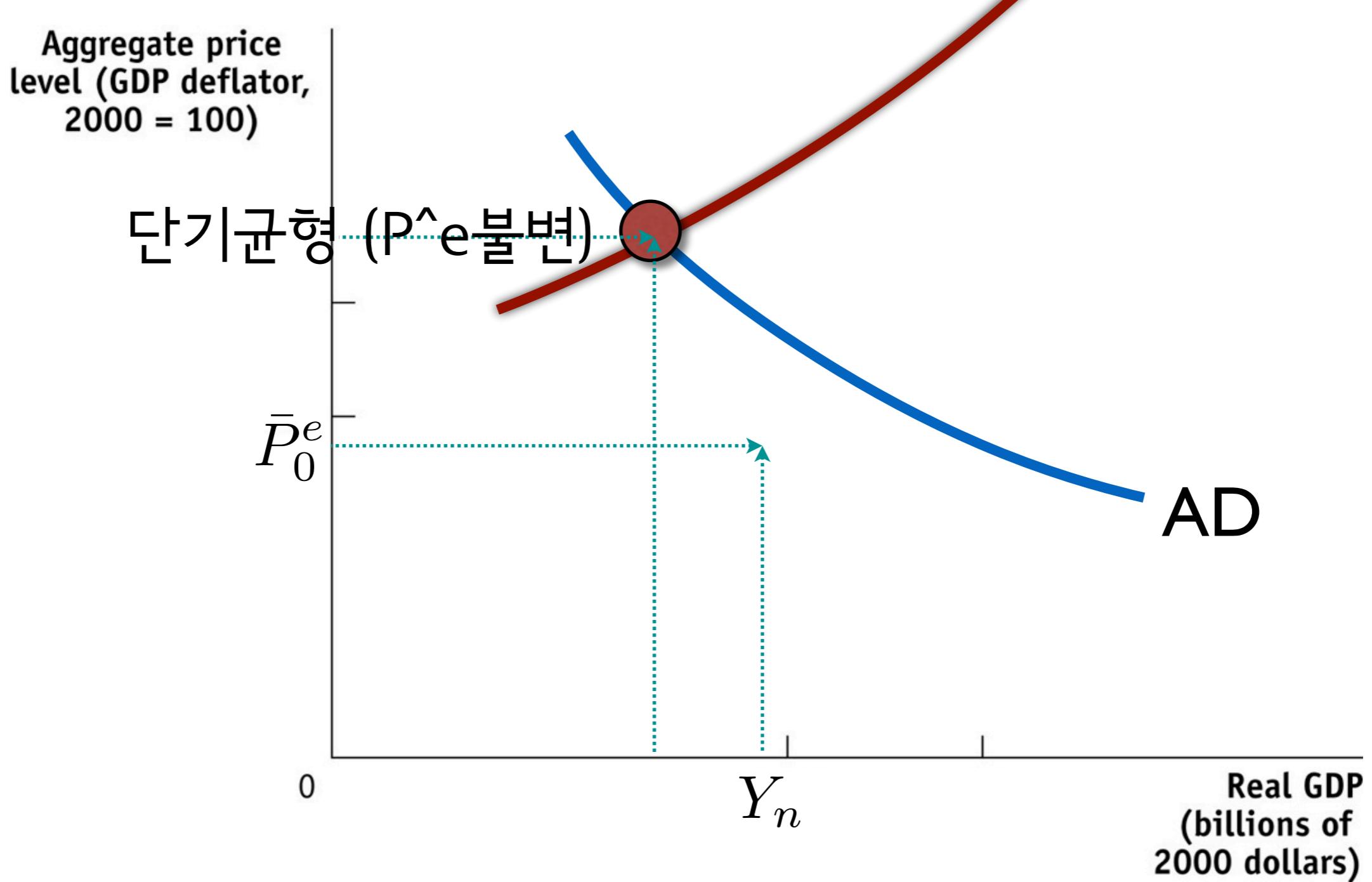
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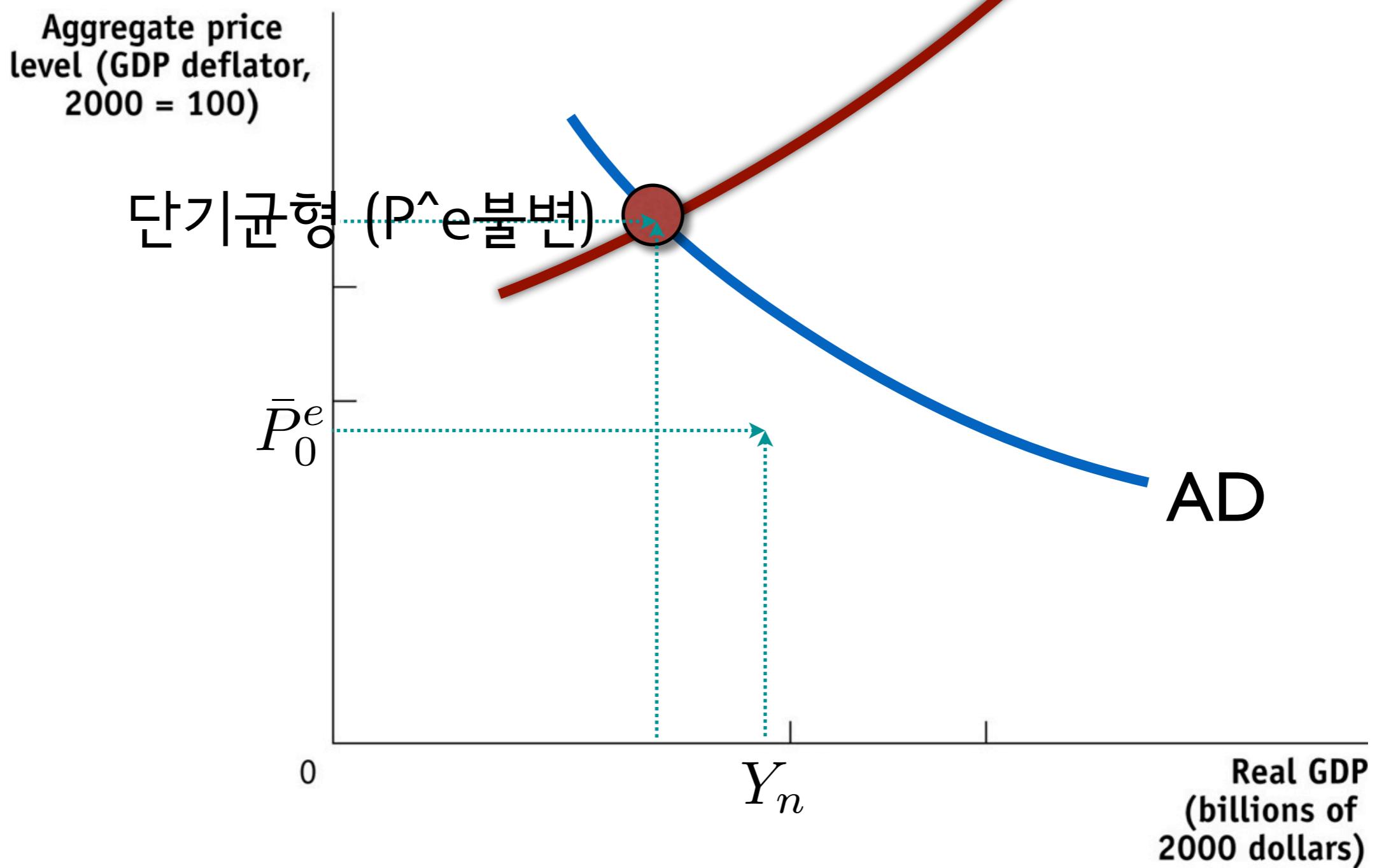


# AS shock (단기-중기): case2



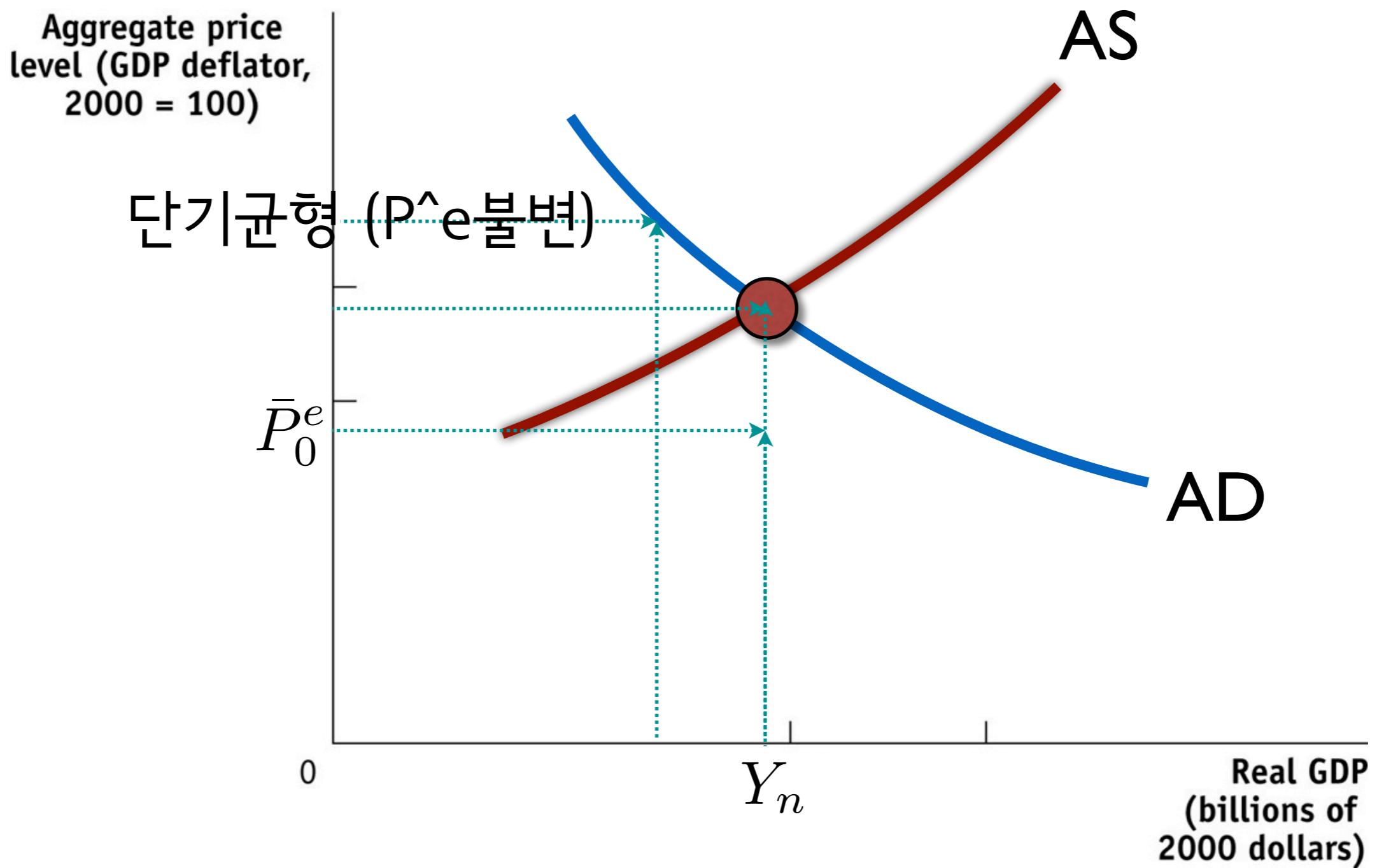
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중기:  $P^e$  하락  $\Rightarrow$  AS 하락

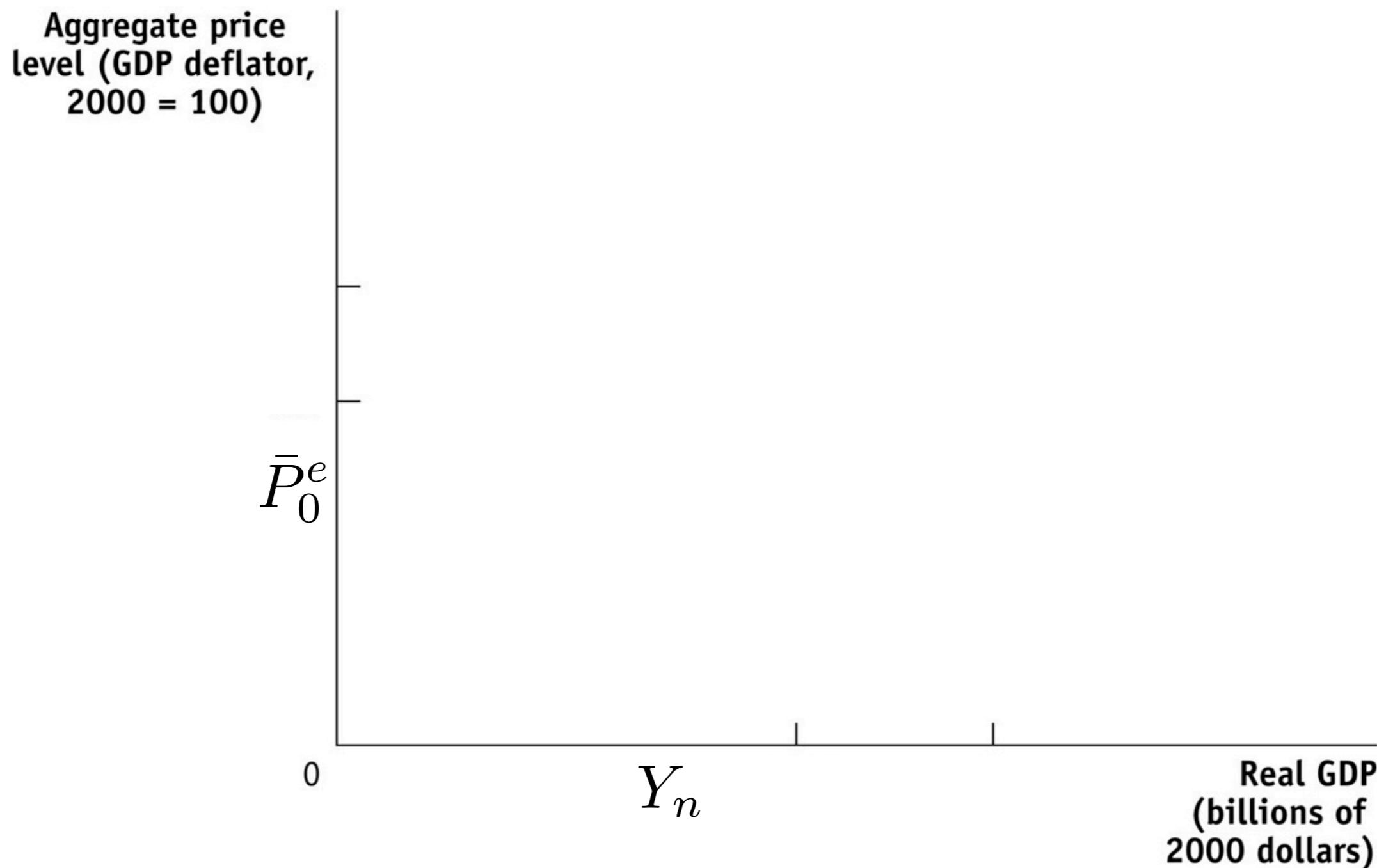


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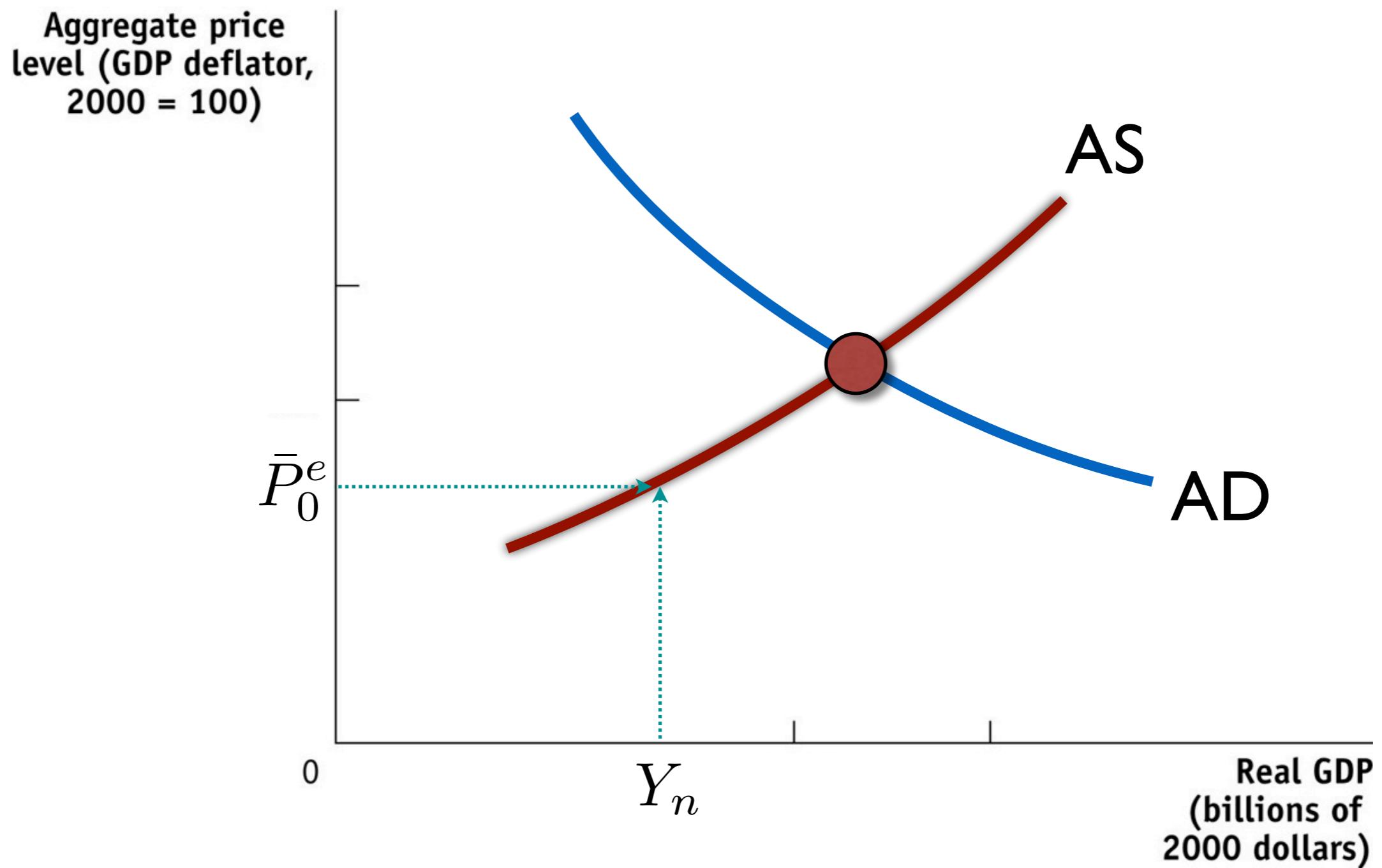
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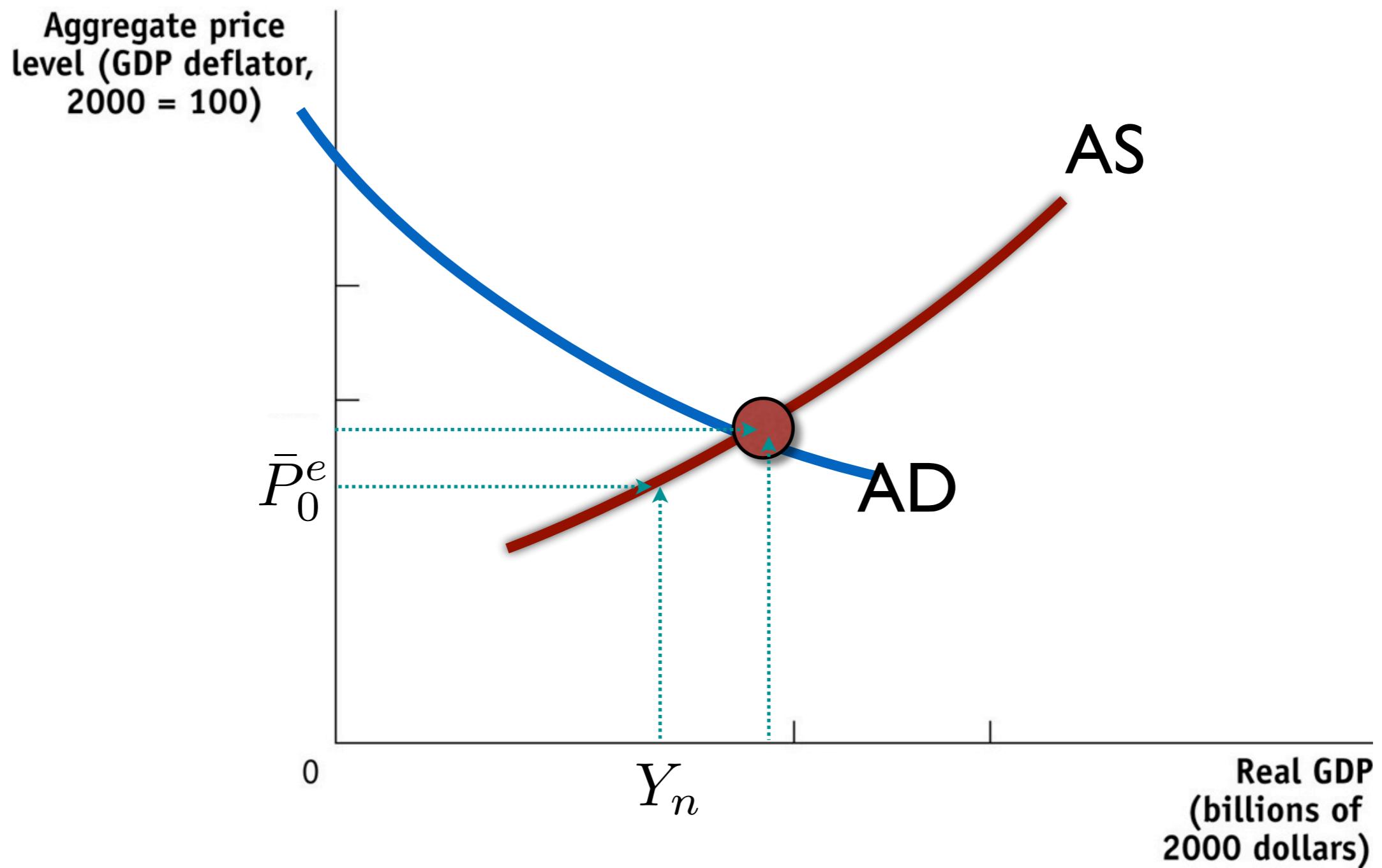
# AD shock (단기-중기)



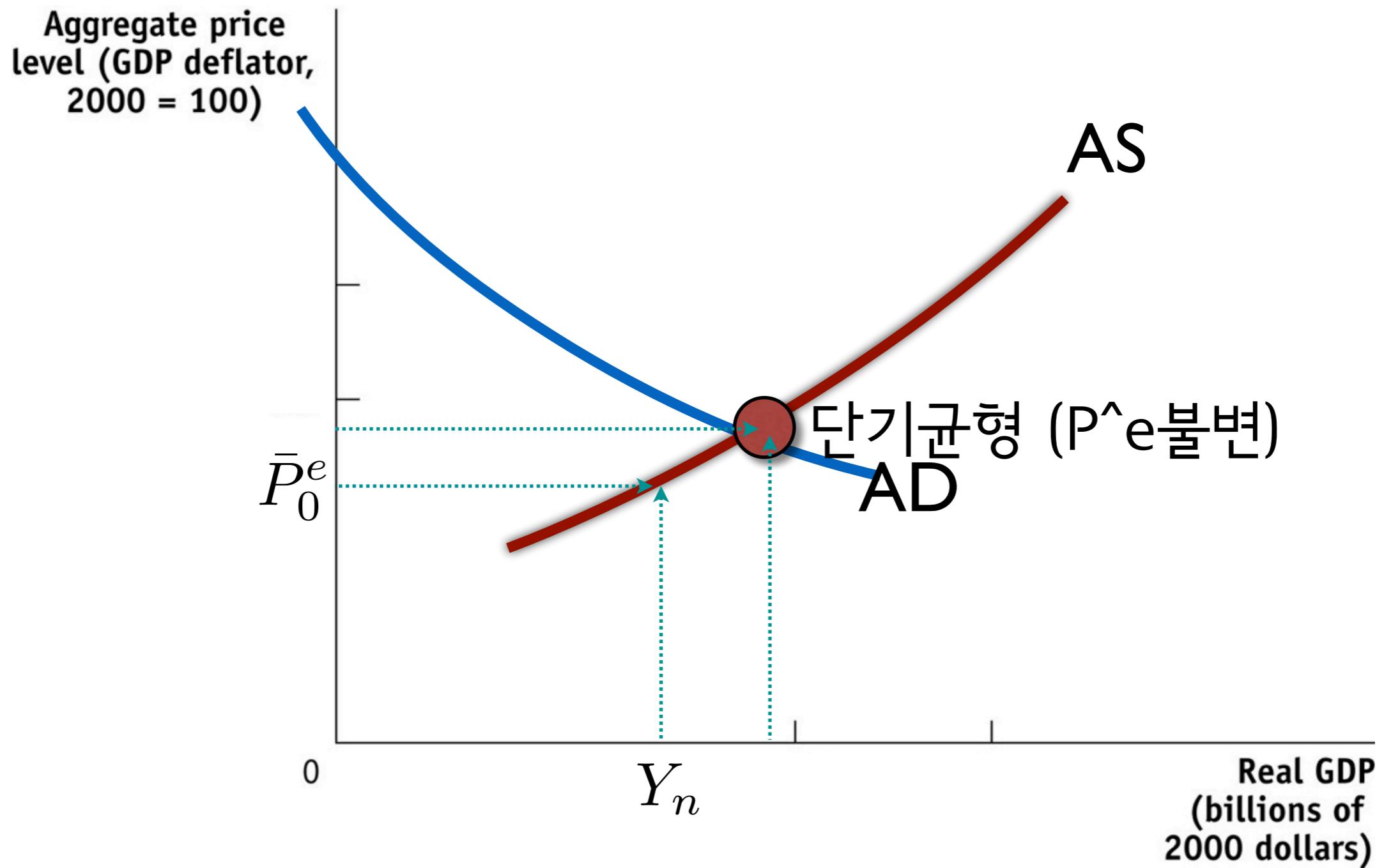
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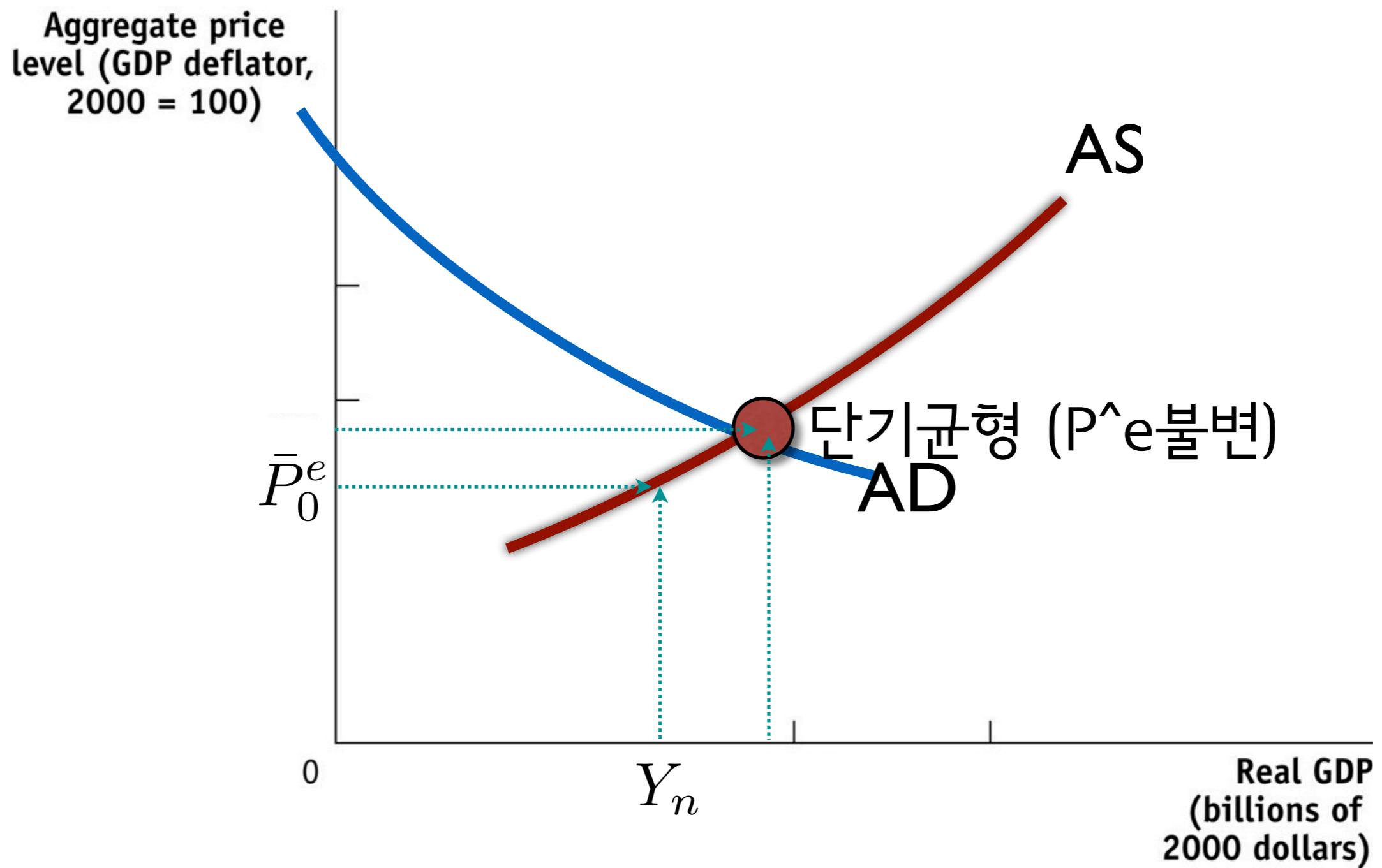


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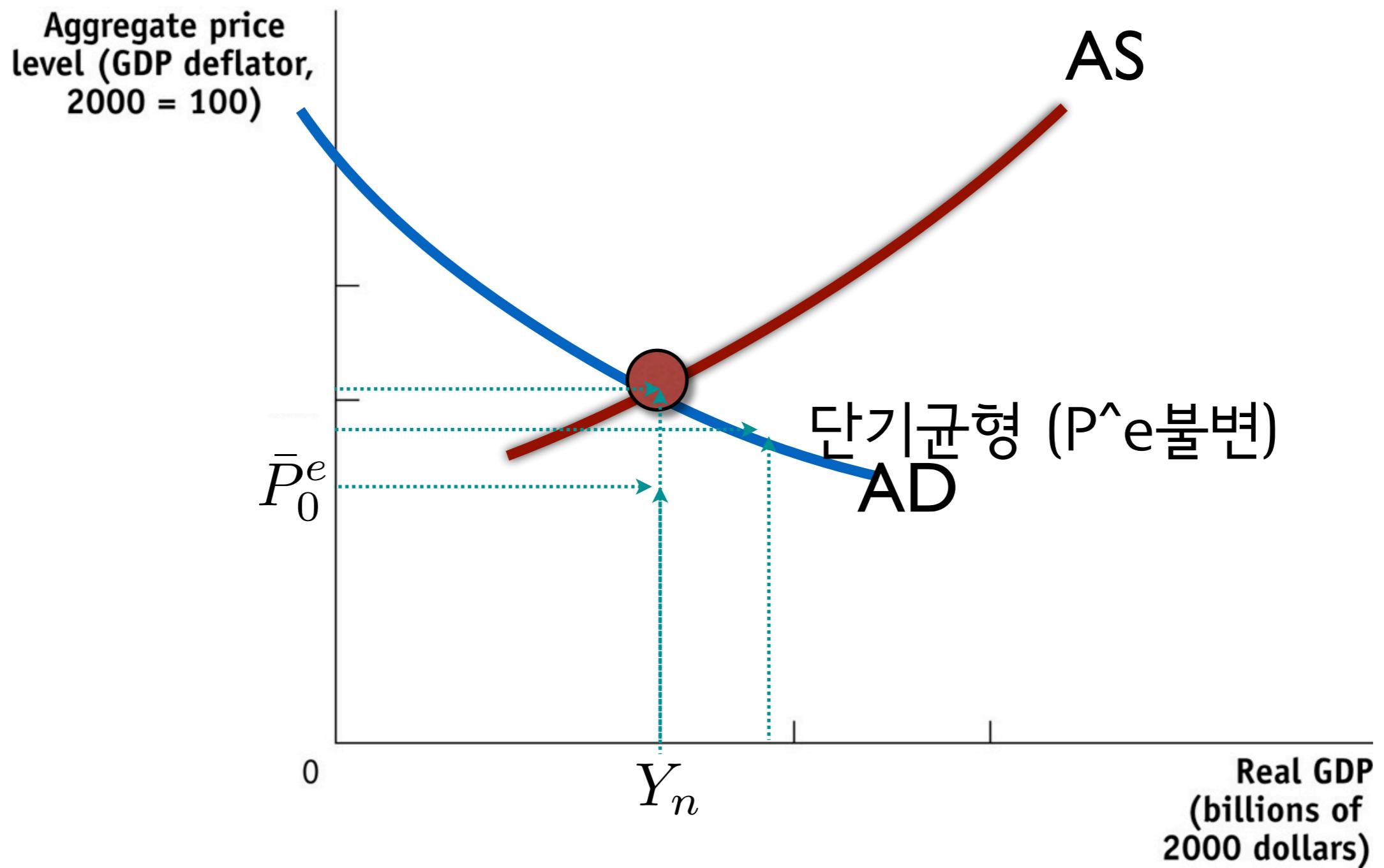
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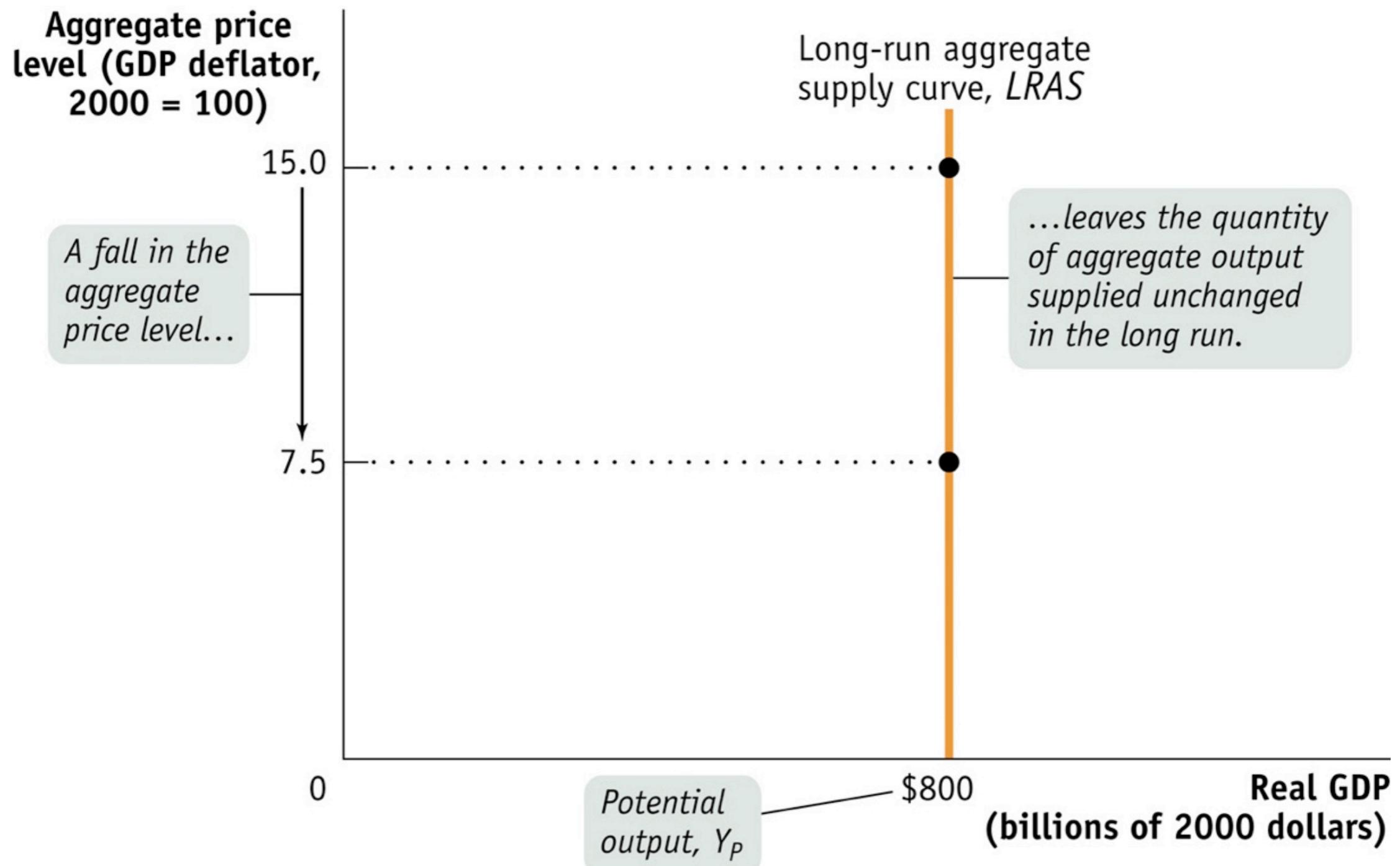
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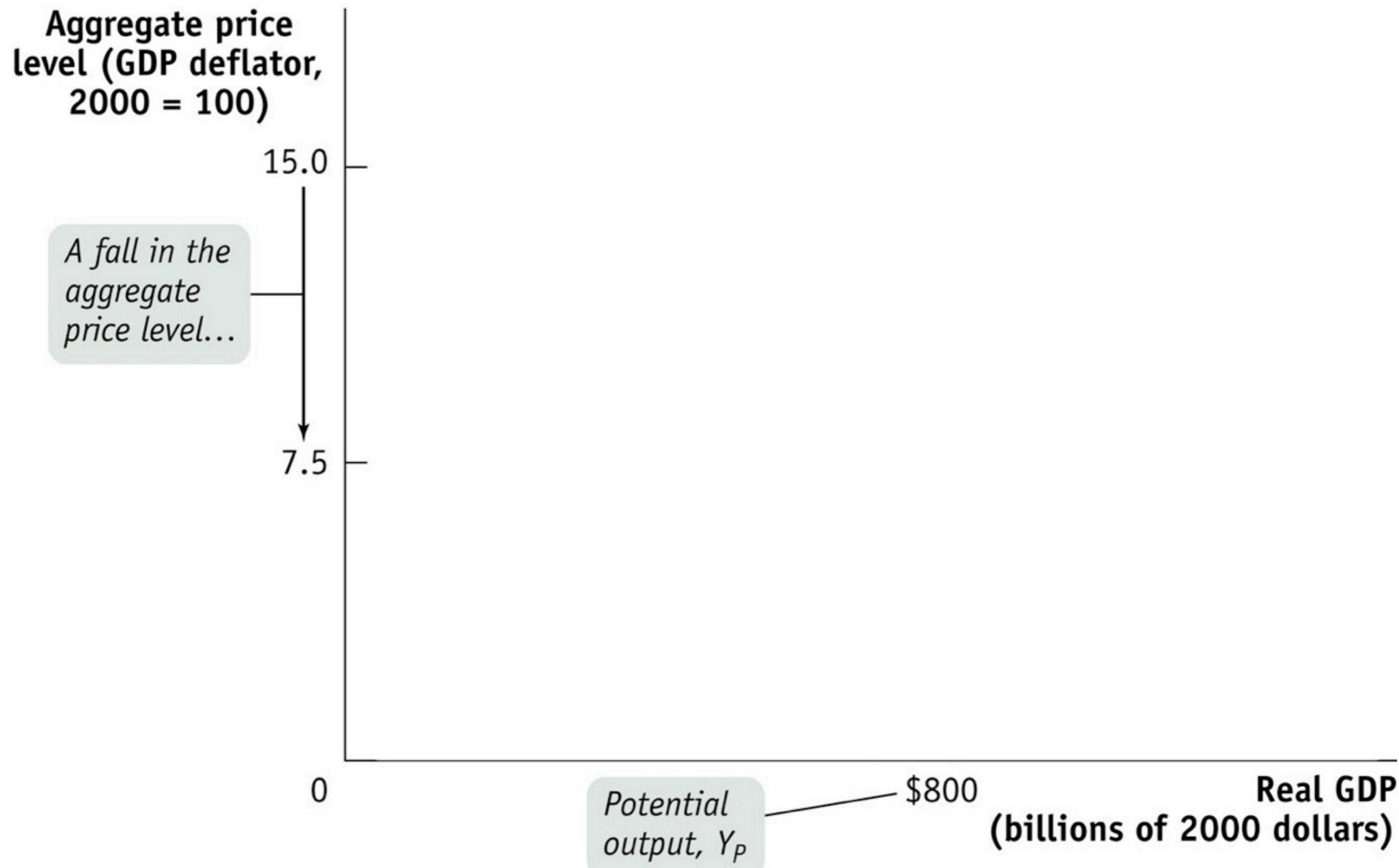
# 중기 종공급곡선

# 중기 총공급곡선

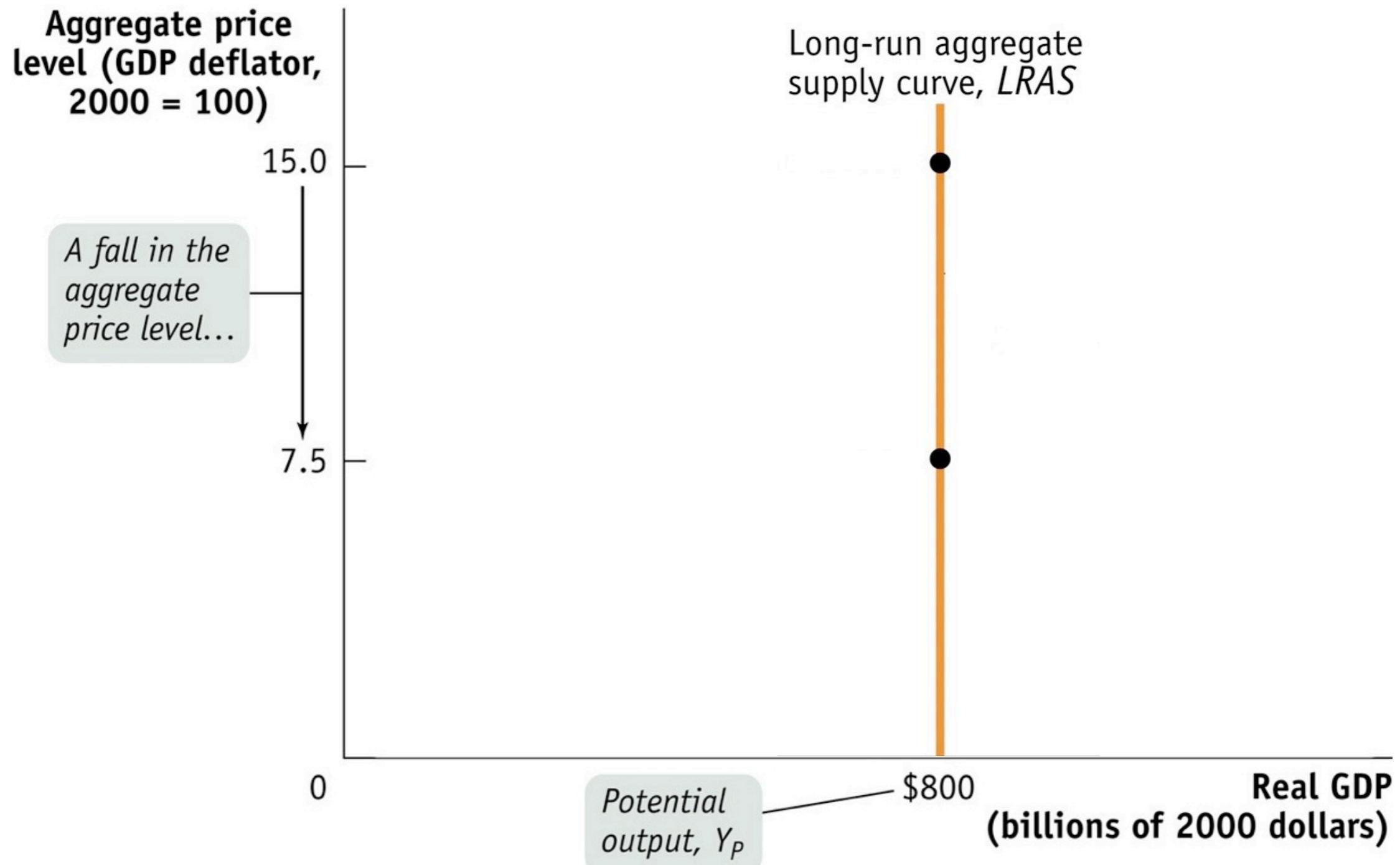


장기: 기술진보  $\Rightarrow Y_n \uparrow$

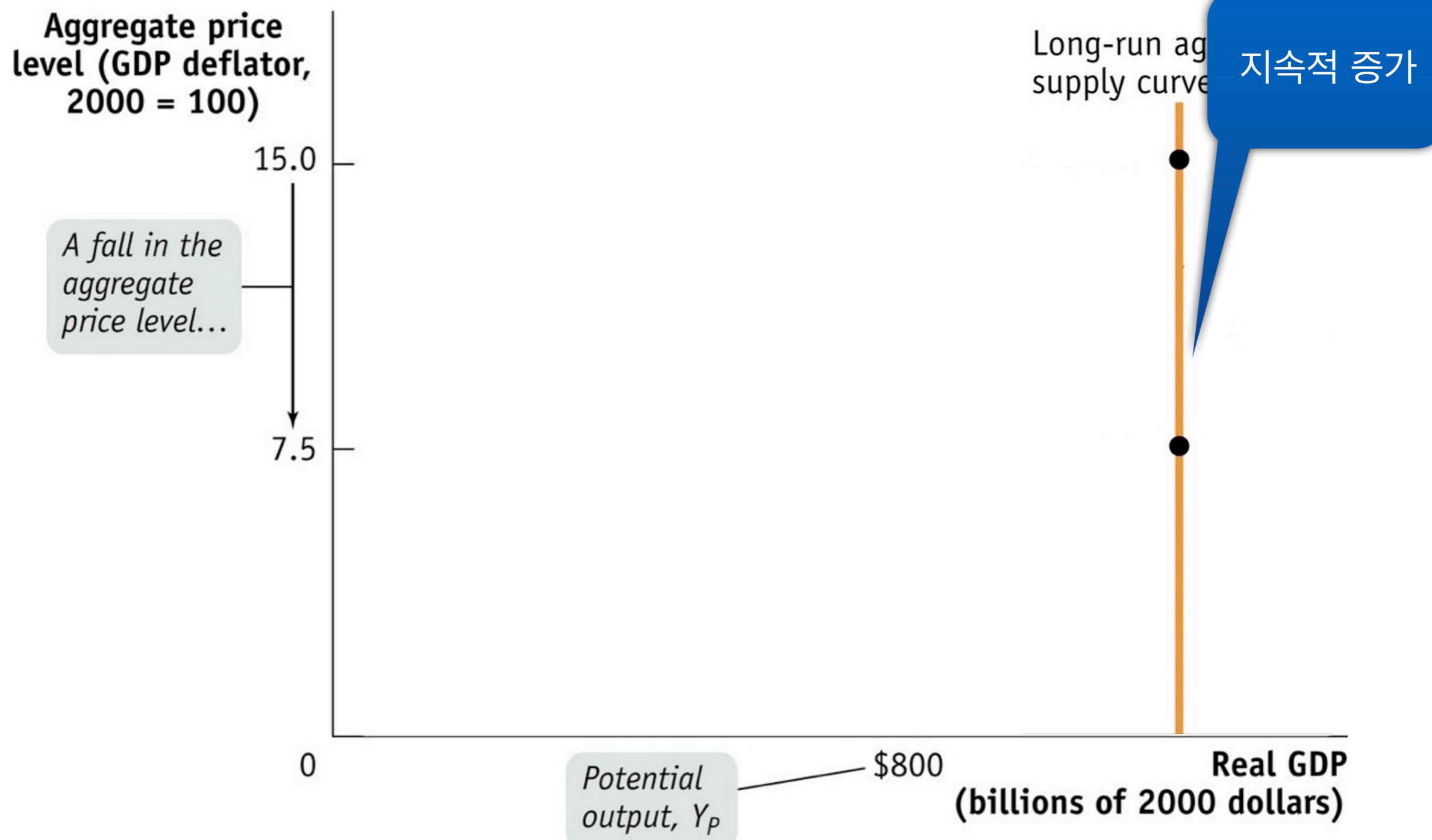
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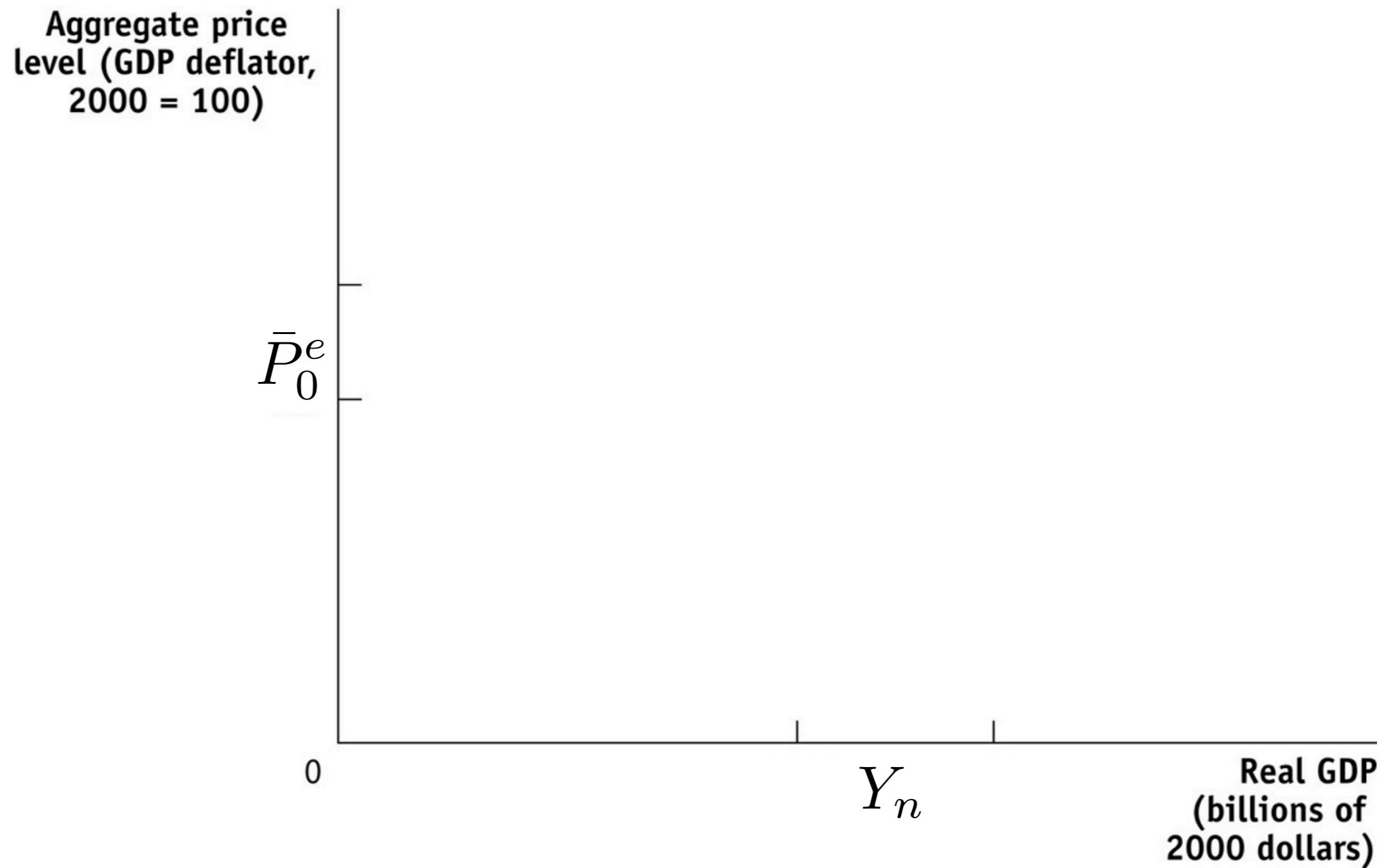
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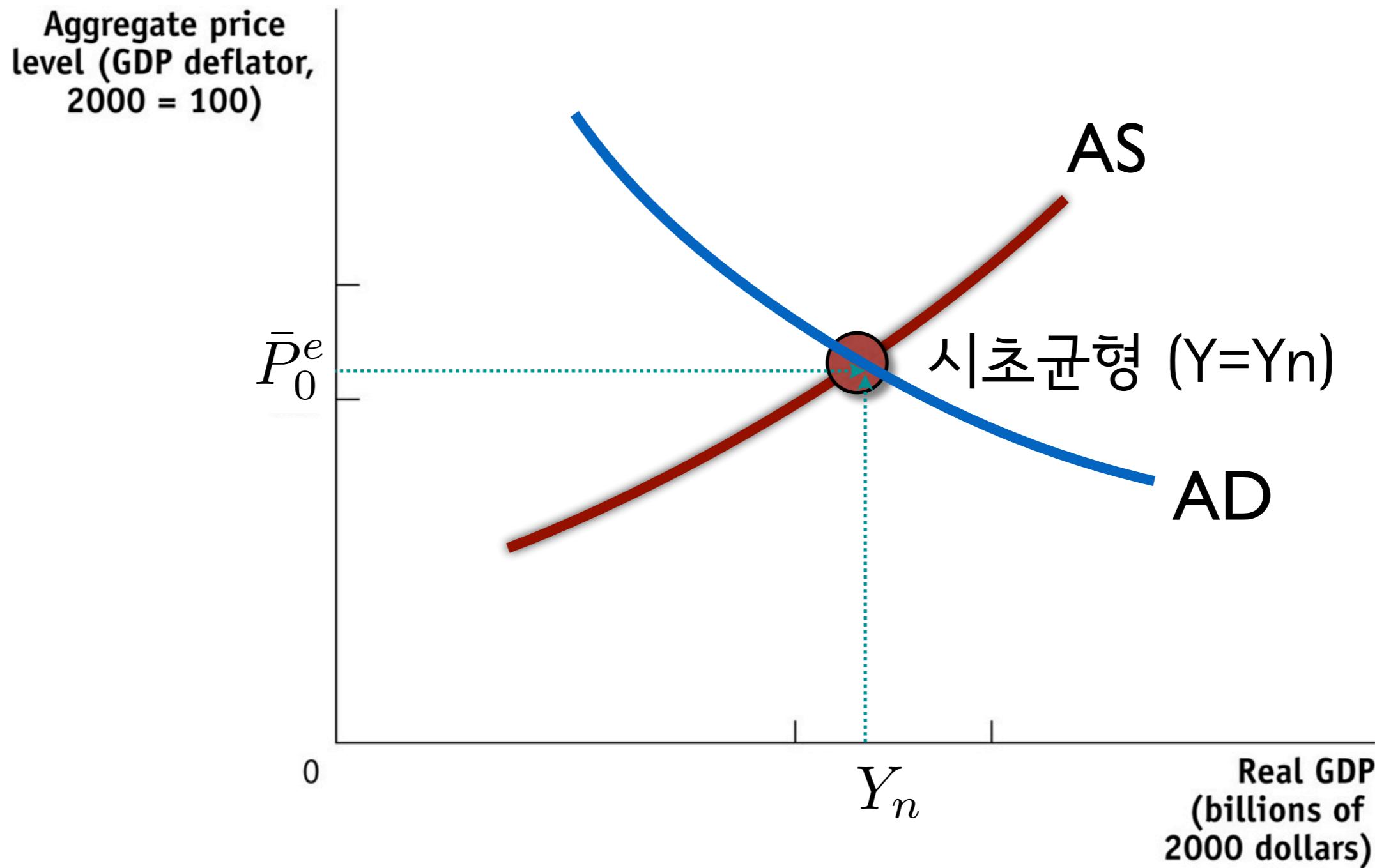
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# 확장적 통화정책

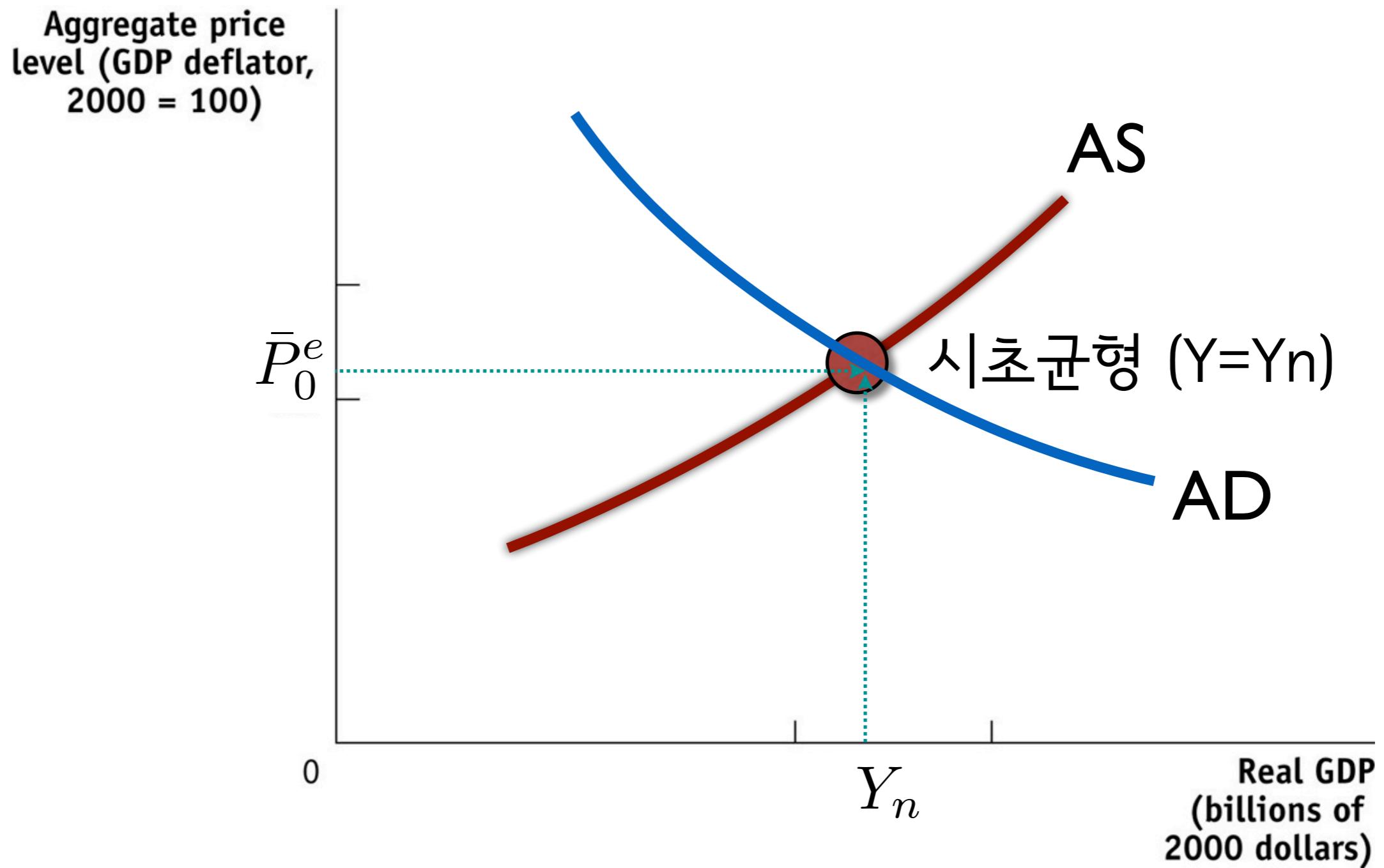


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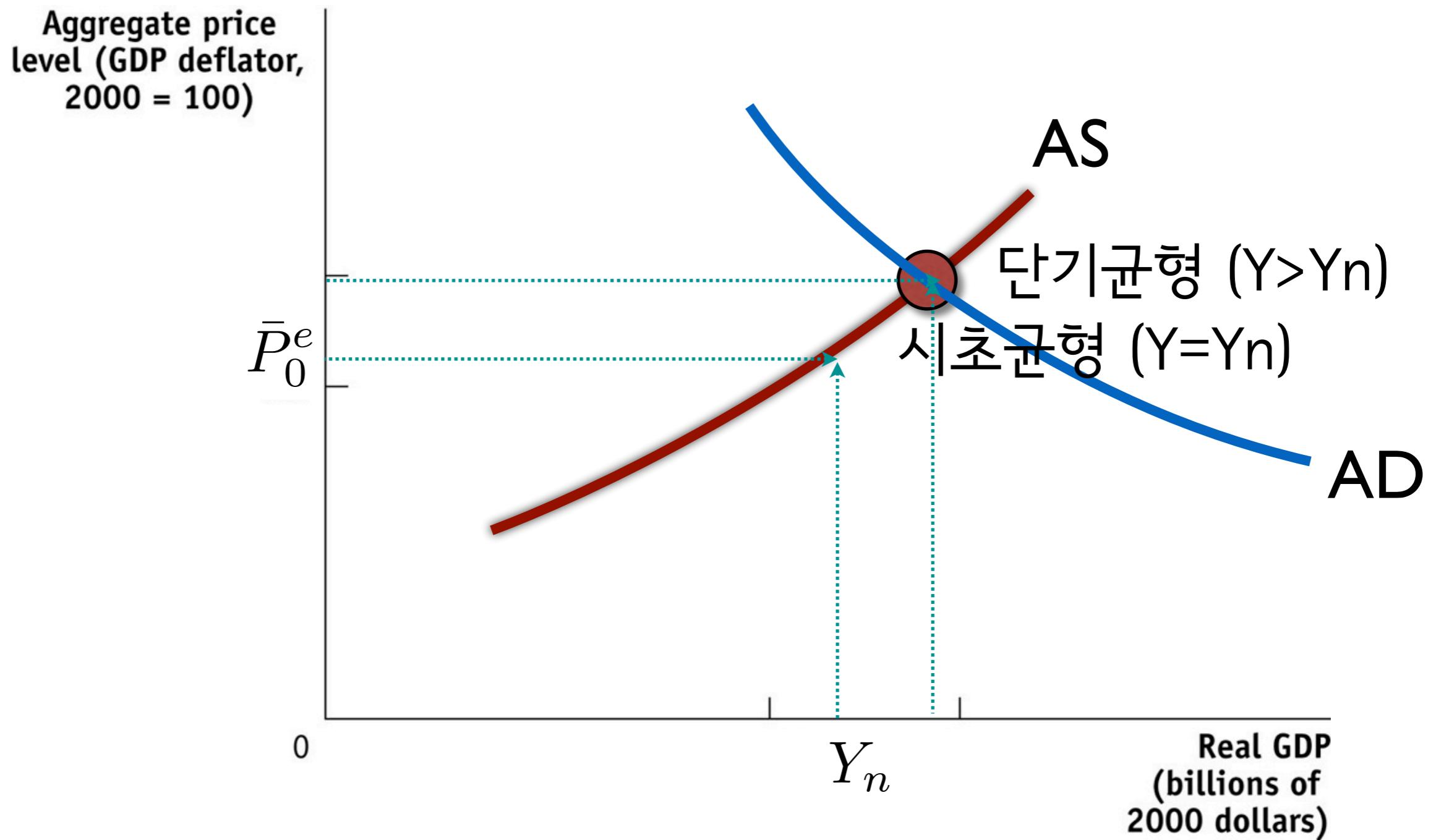
# 확장적 통화정책

단기: AD 오른쪽 이동



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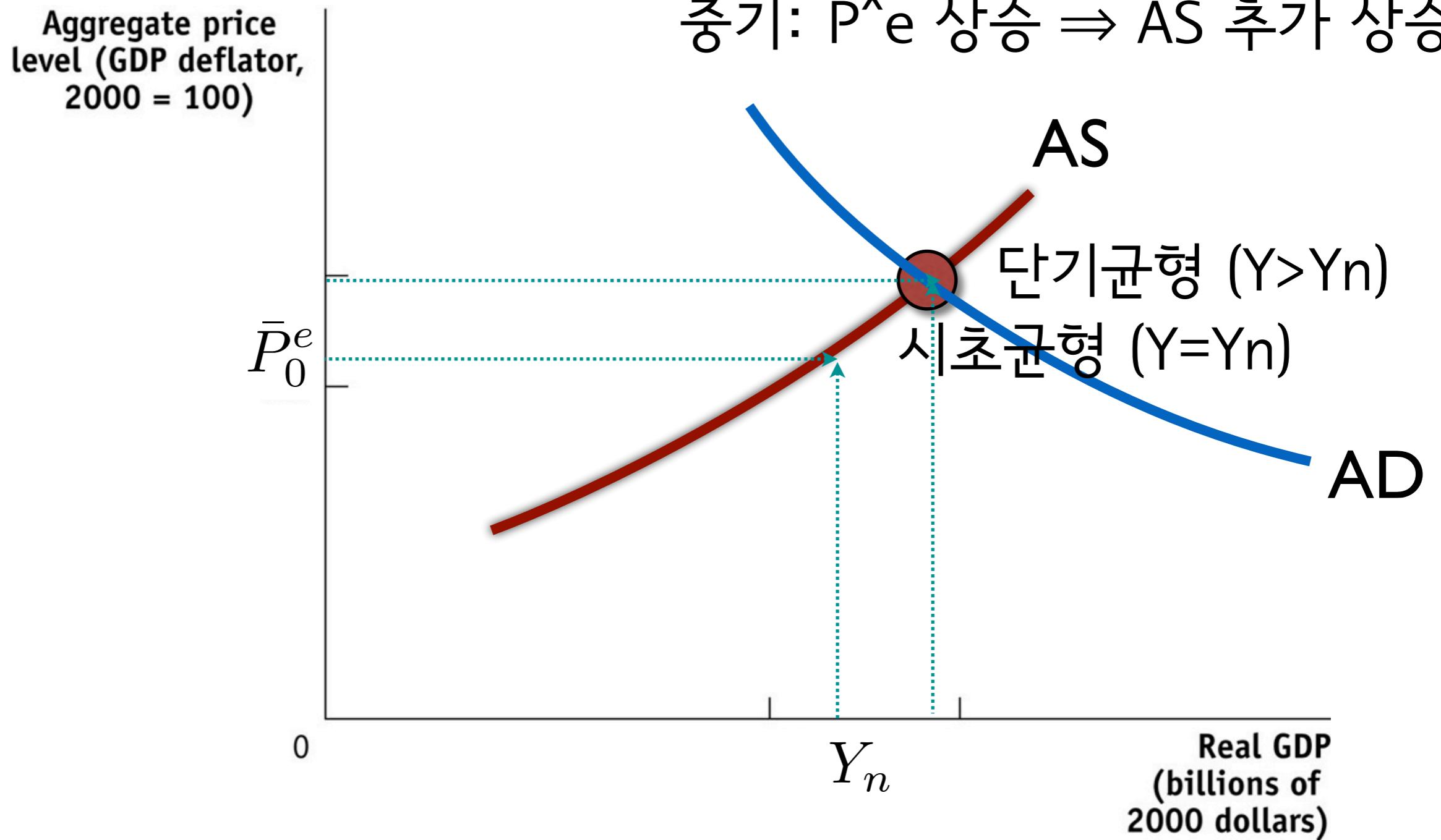
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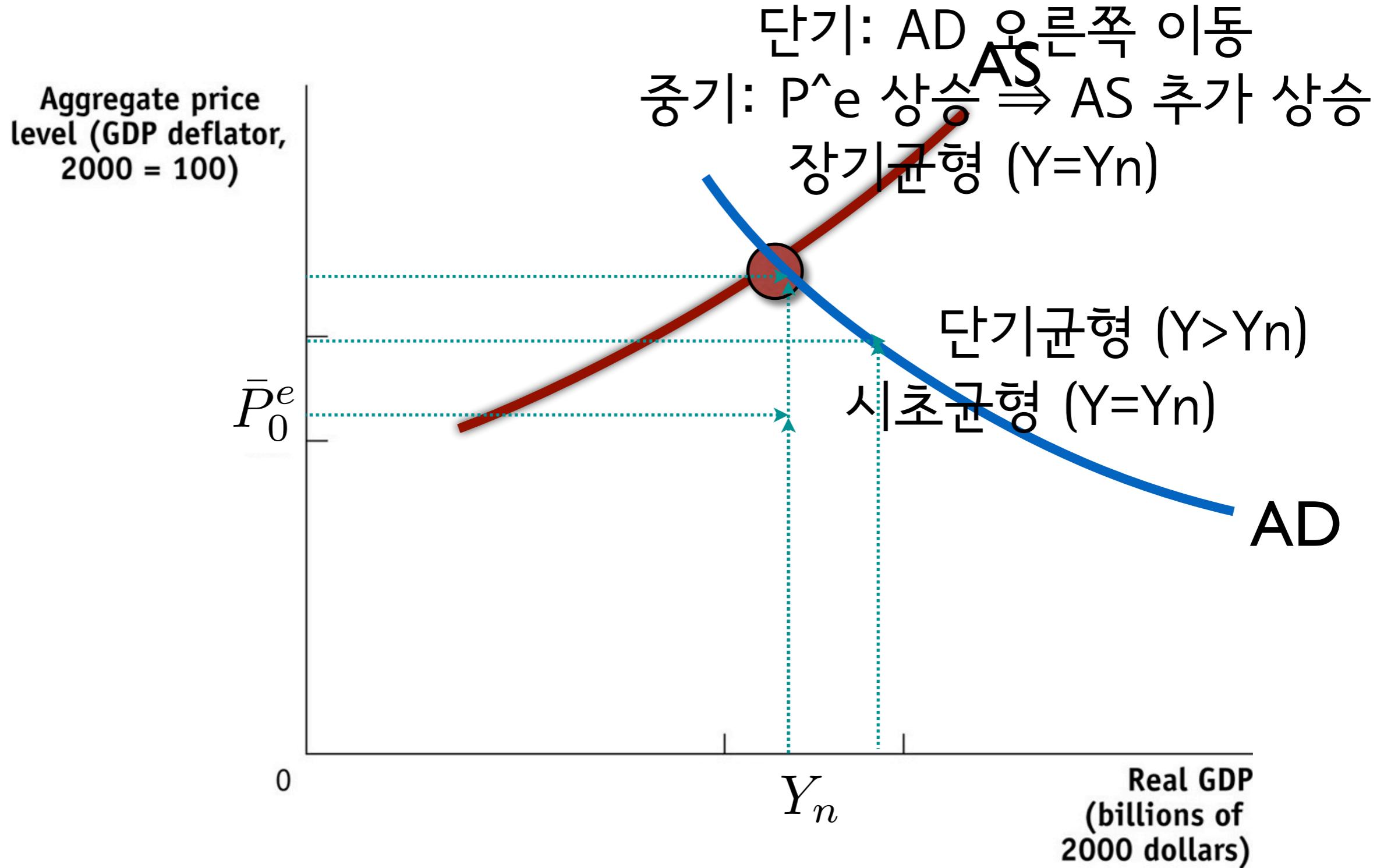
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단기: AD 오른쪽 이동

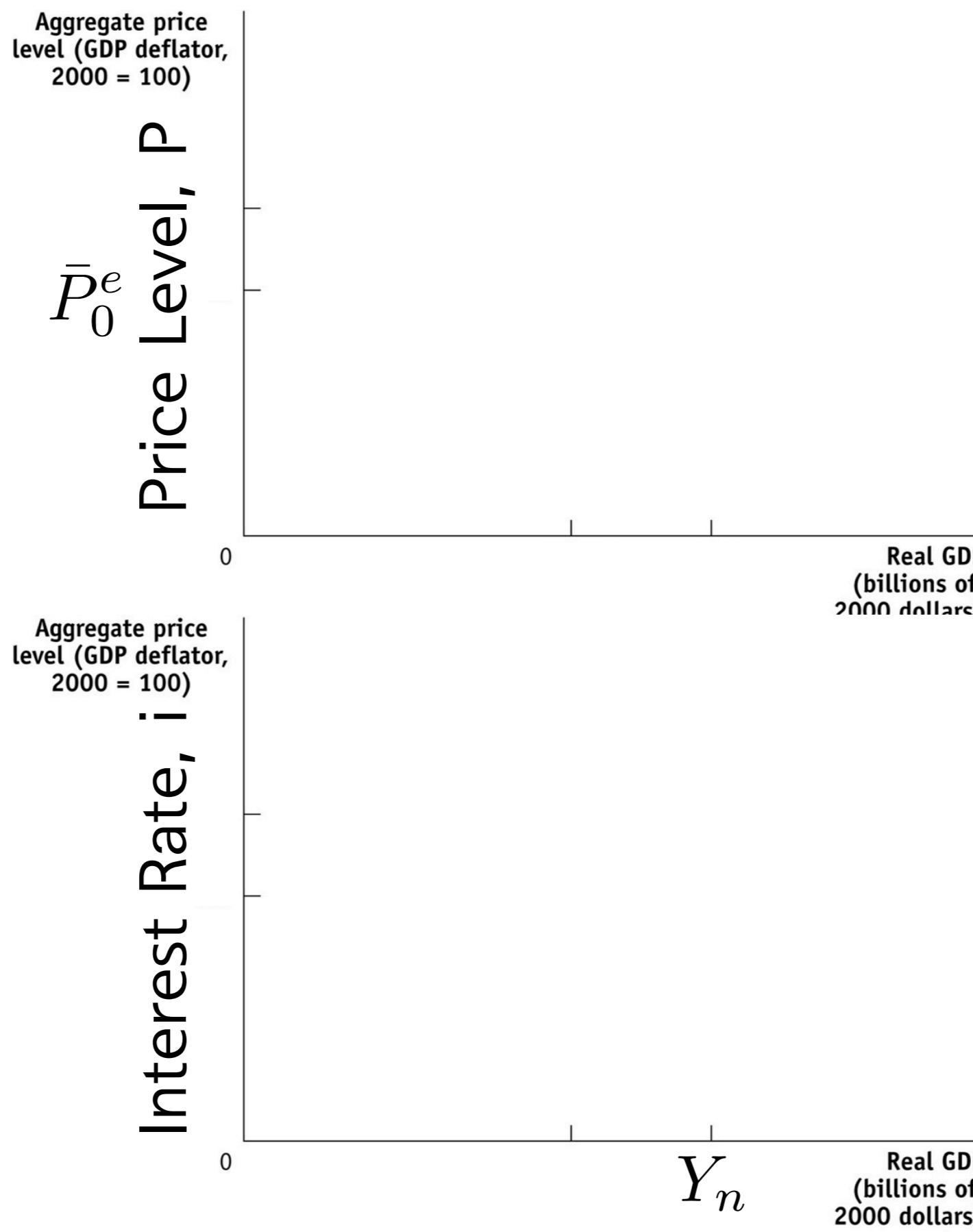
중기:  $P^e$  상승  $\Rightarrow$  AS 추가 상승



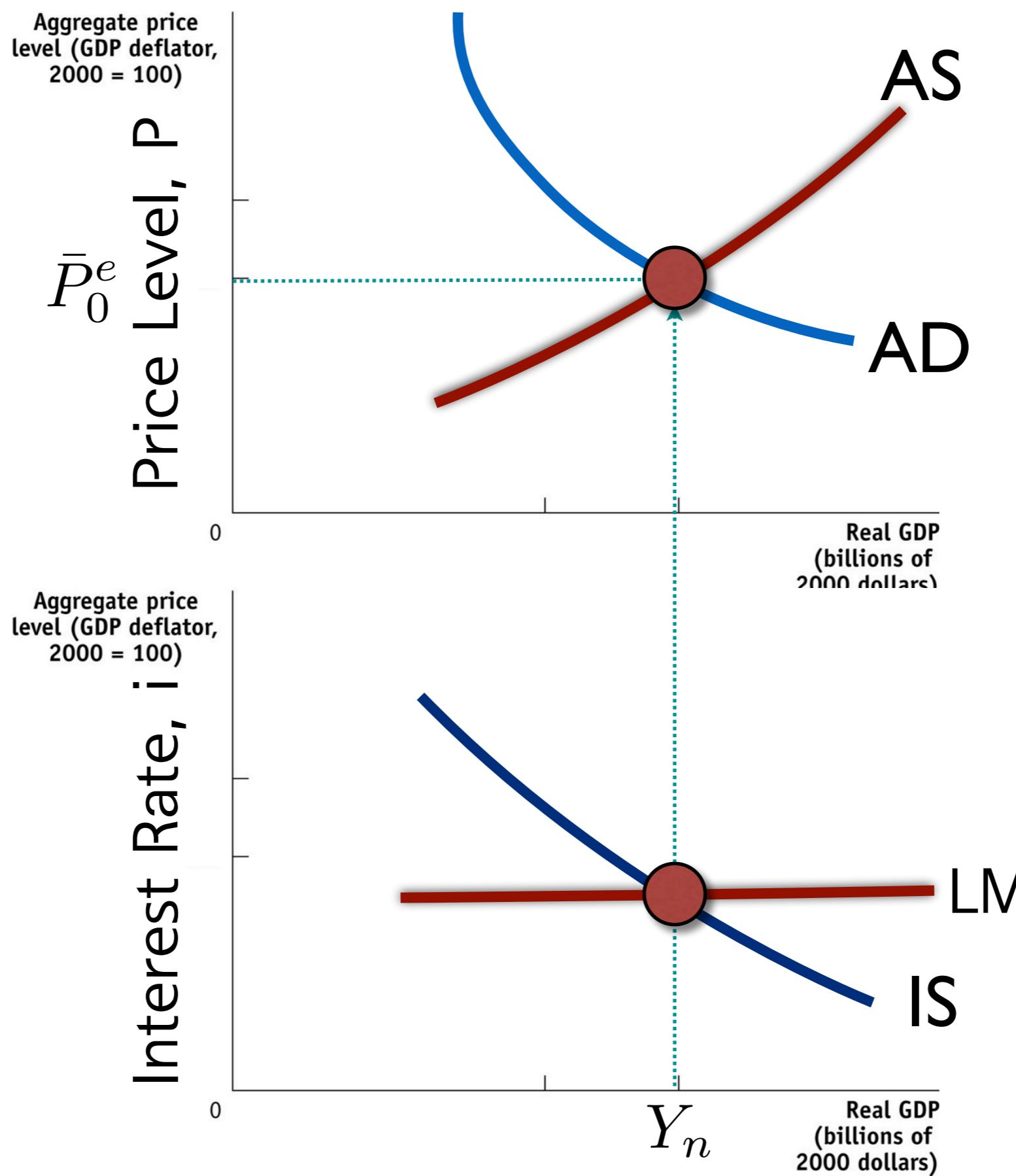
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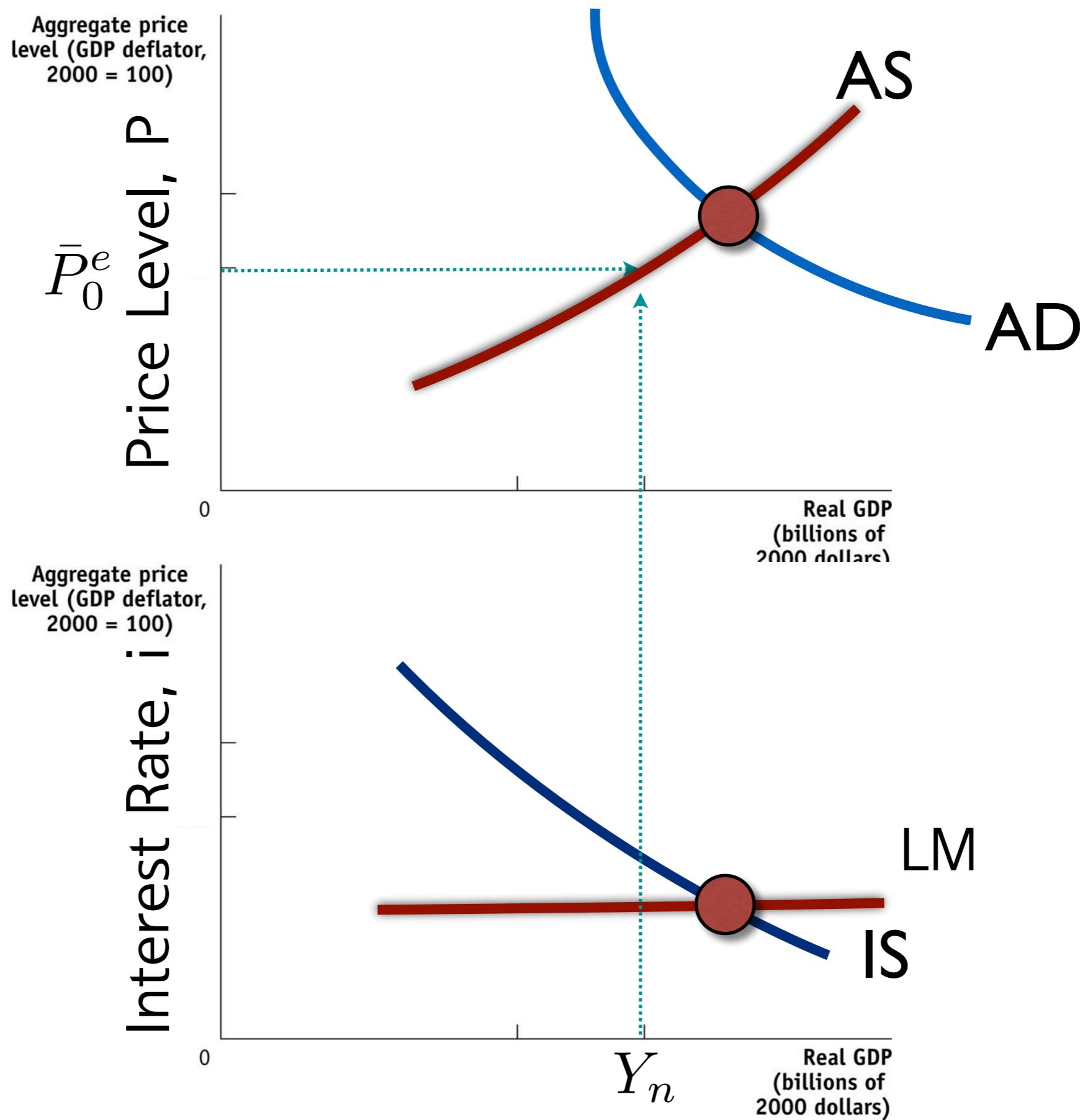
# 확장 통화정책의 동학



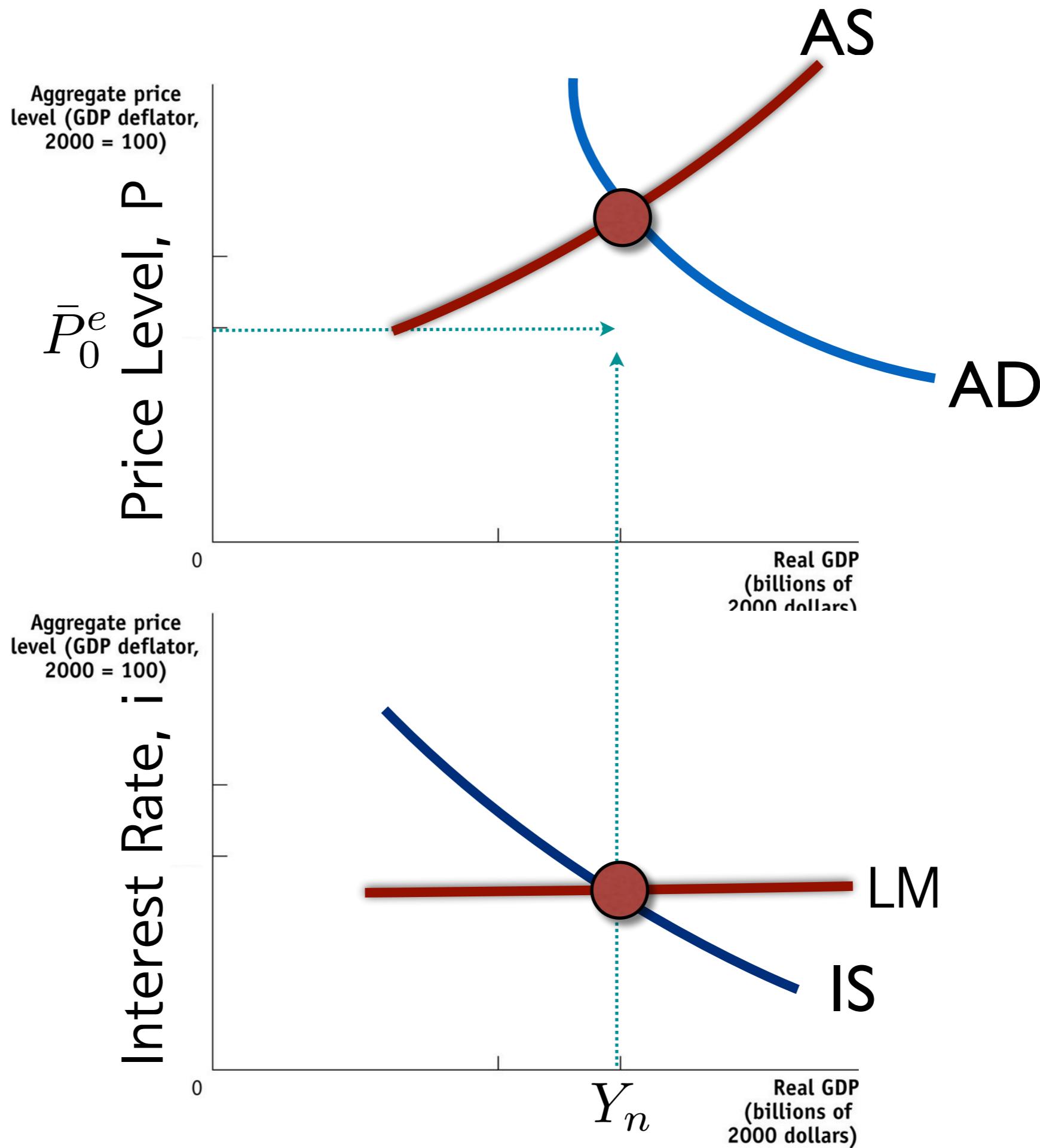
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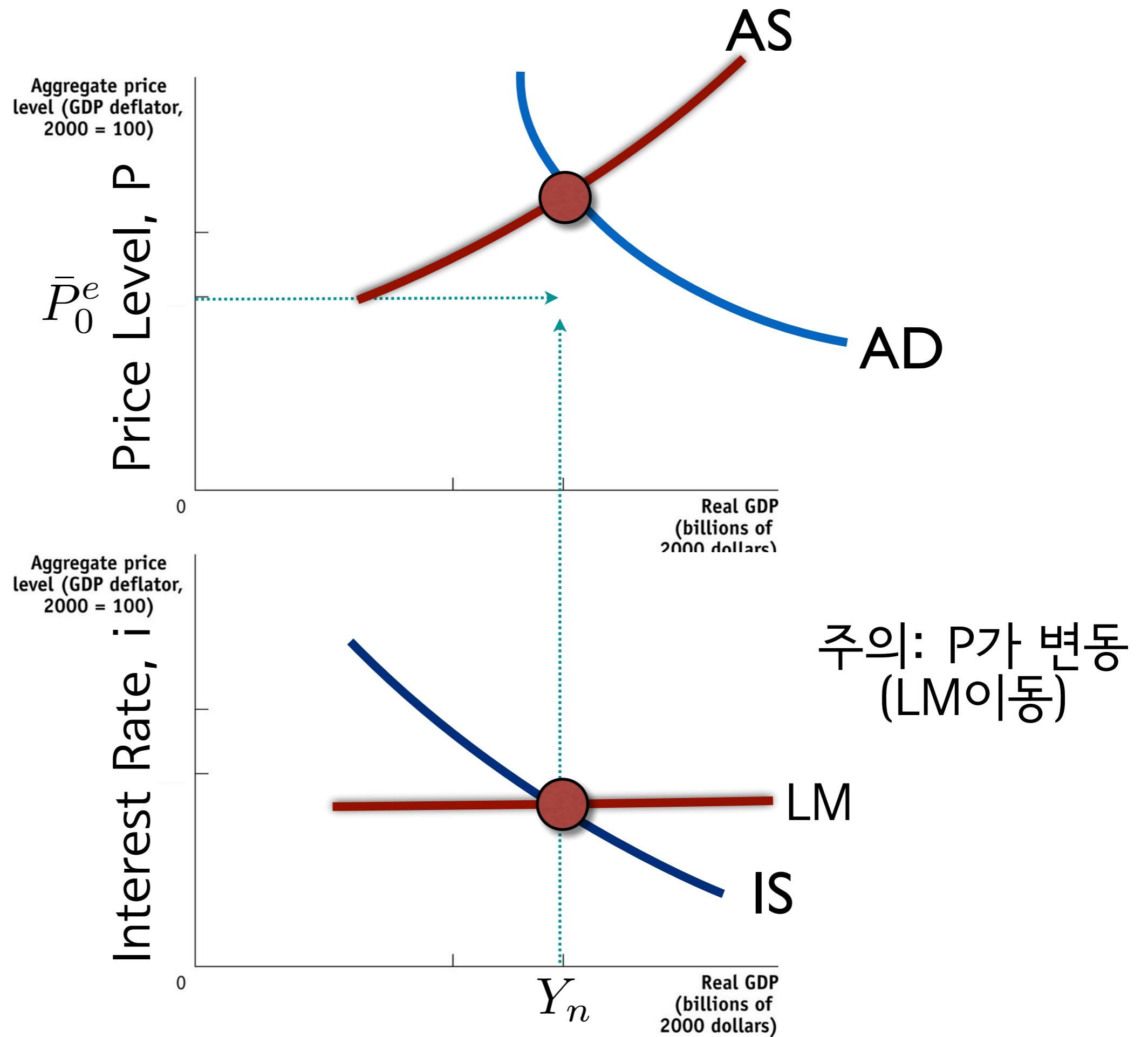
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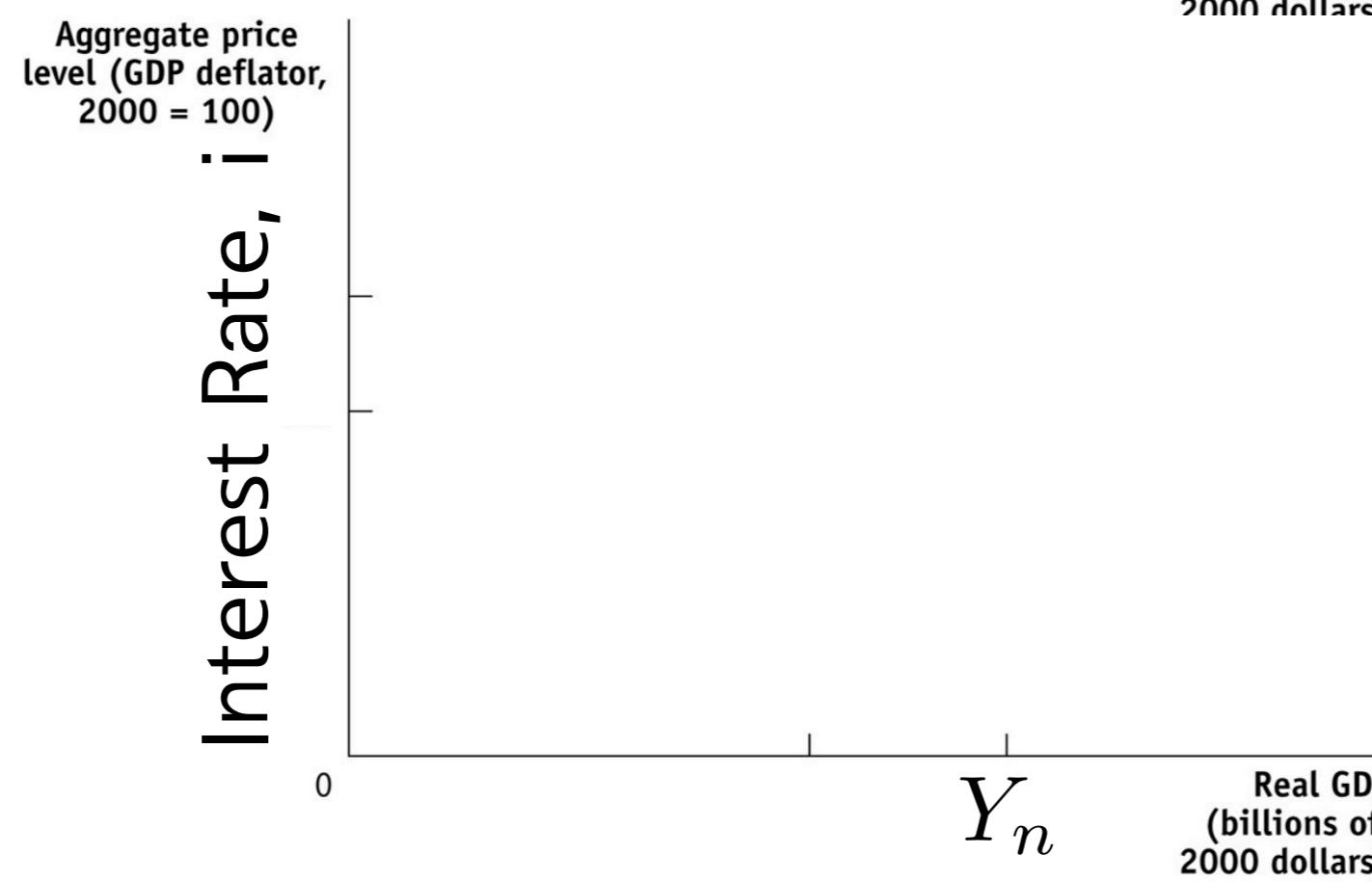
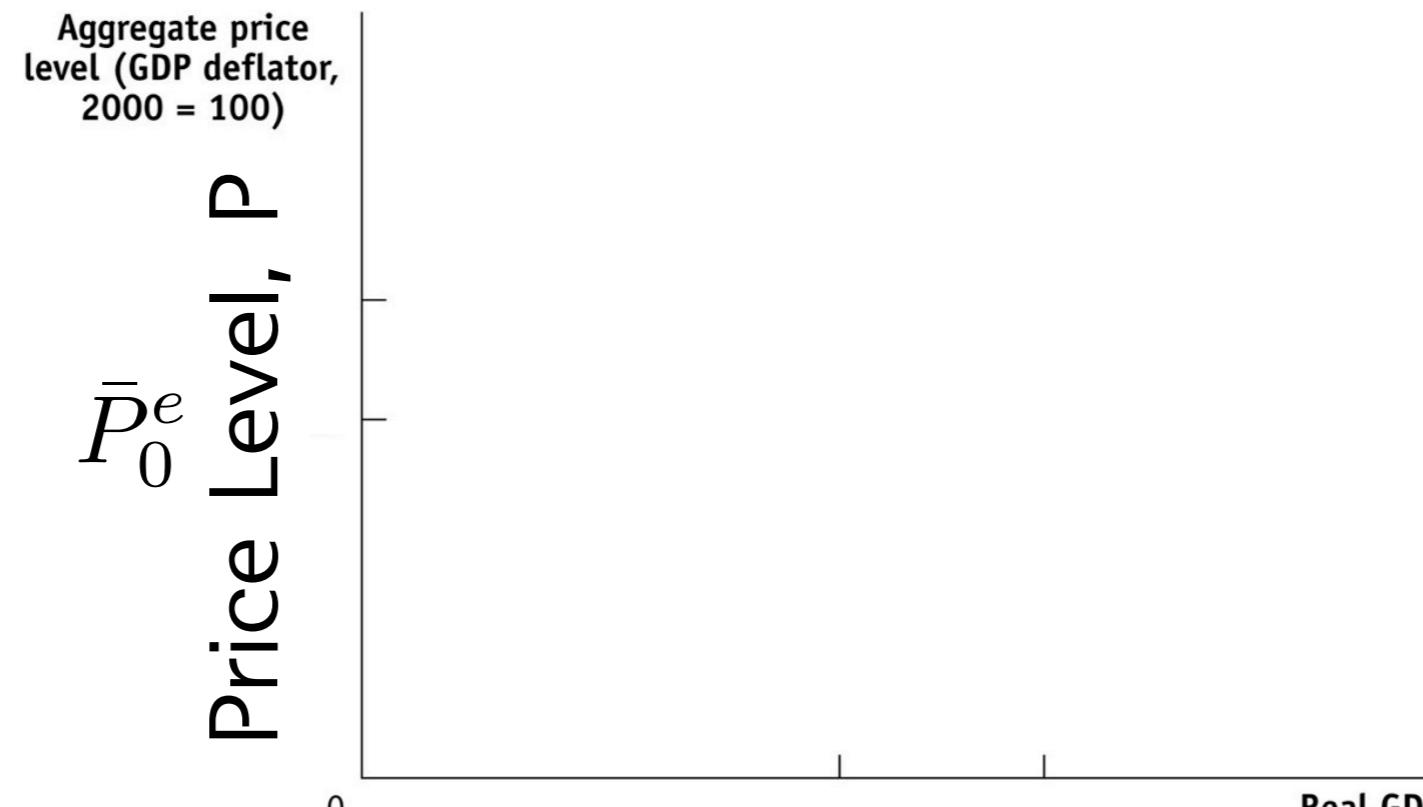
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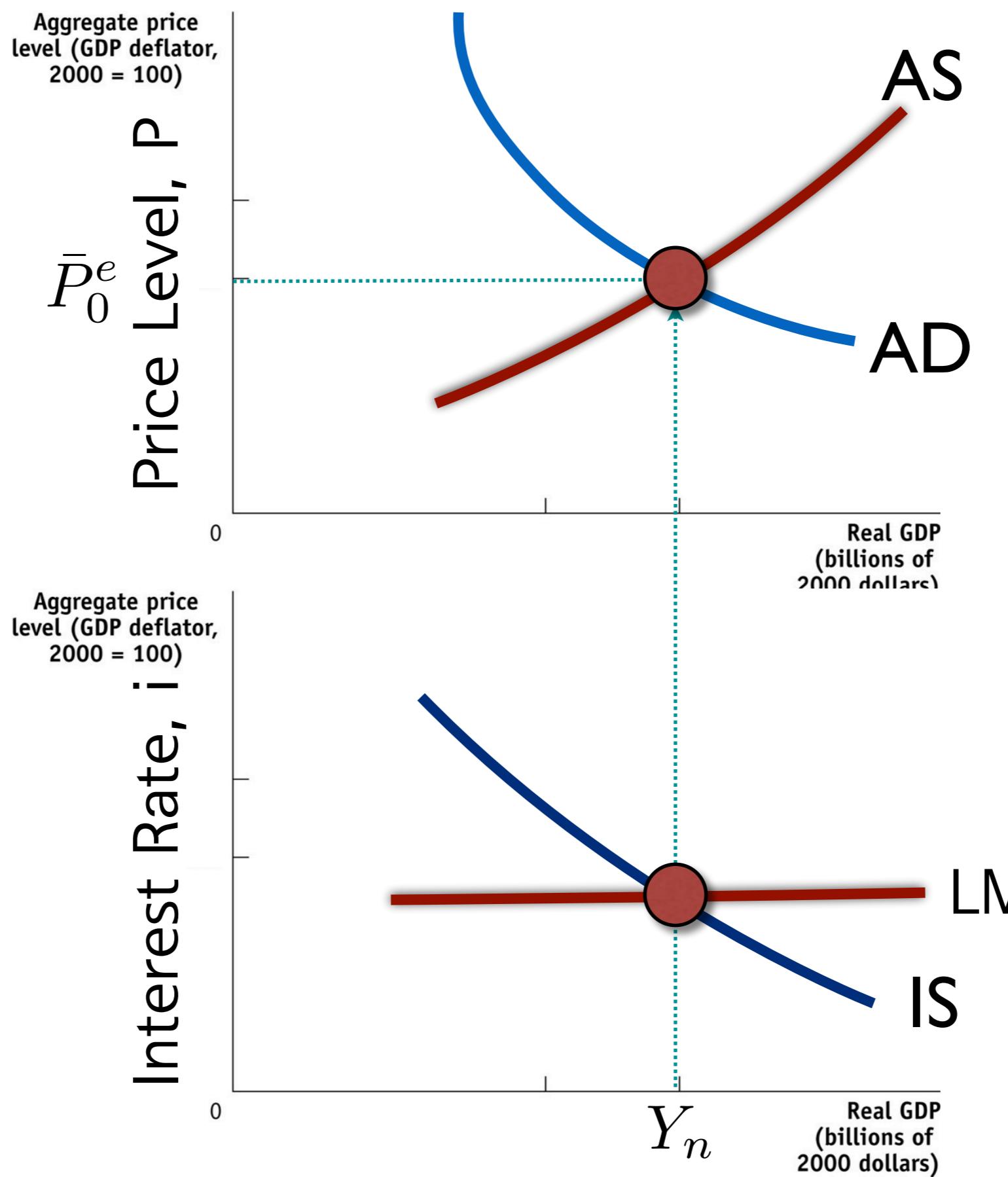
# 화폐중립성 Money Neutrality

- 단기에는 확장정책이 output을 증가시킨다
- 중기에는 물가 변화로 output은 잠재생산량( $Y_n$ )으로 돌아오게 된다
  - 즉 확장 정책은 지속적인 산출량 증가를 달성할 수 없다.
- 하지만 정책은 shock의 지속시간과 shock으로 인한 충격을 완화시킬 수 있으므로 중요함.

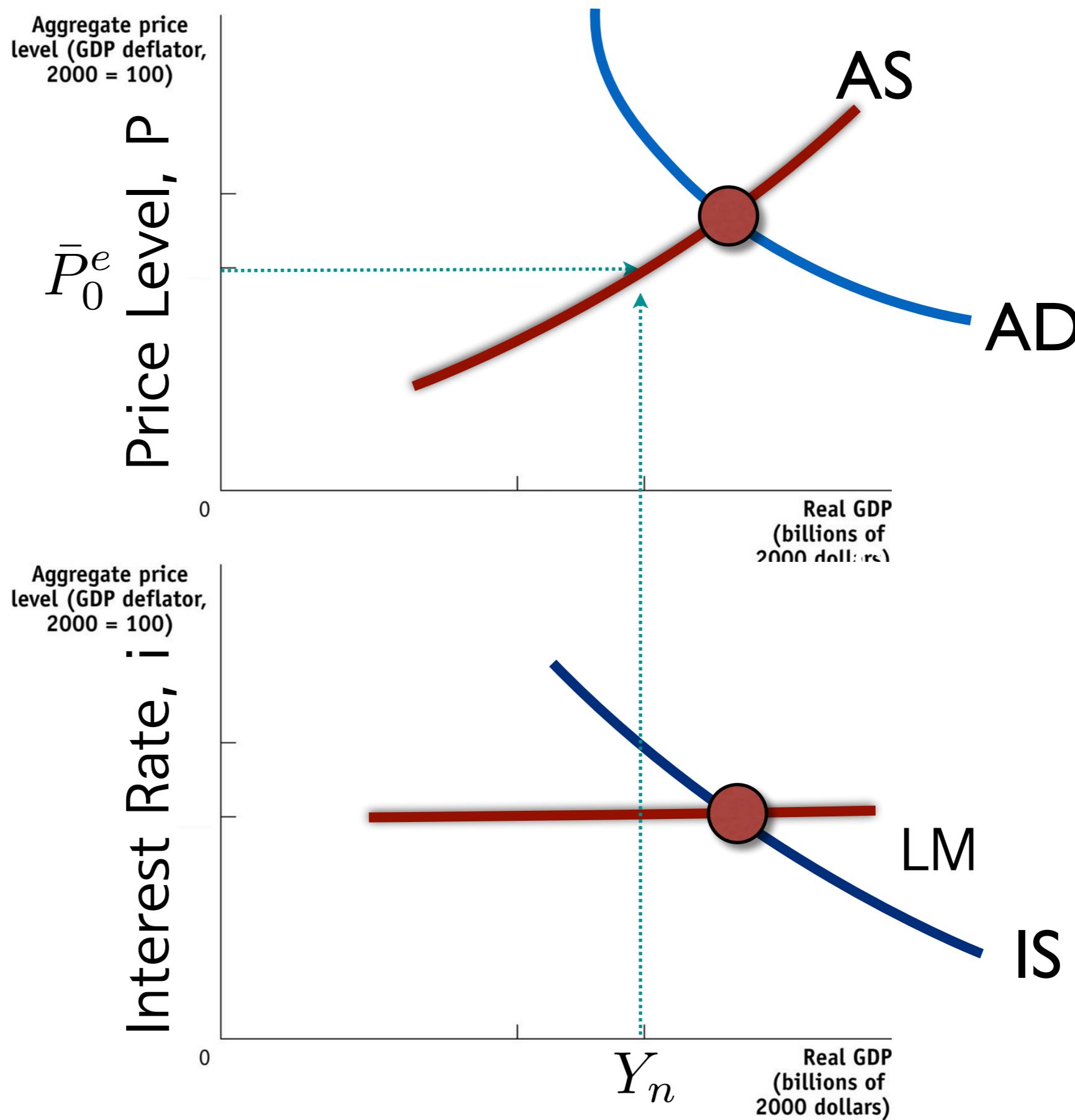
# 확장 재정정책의 동학



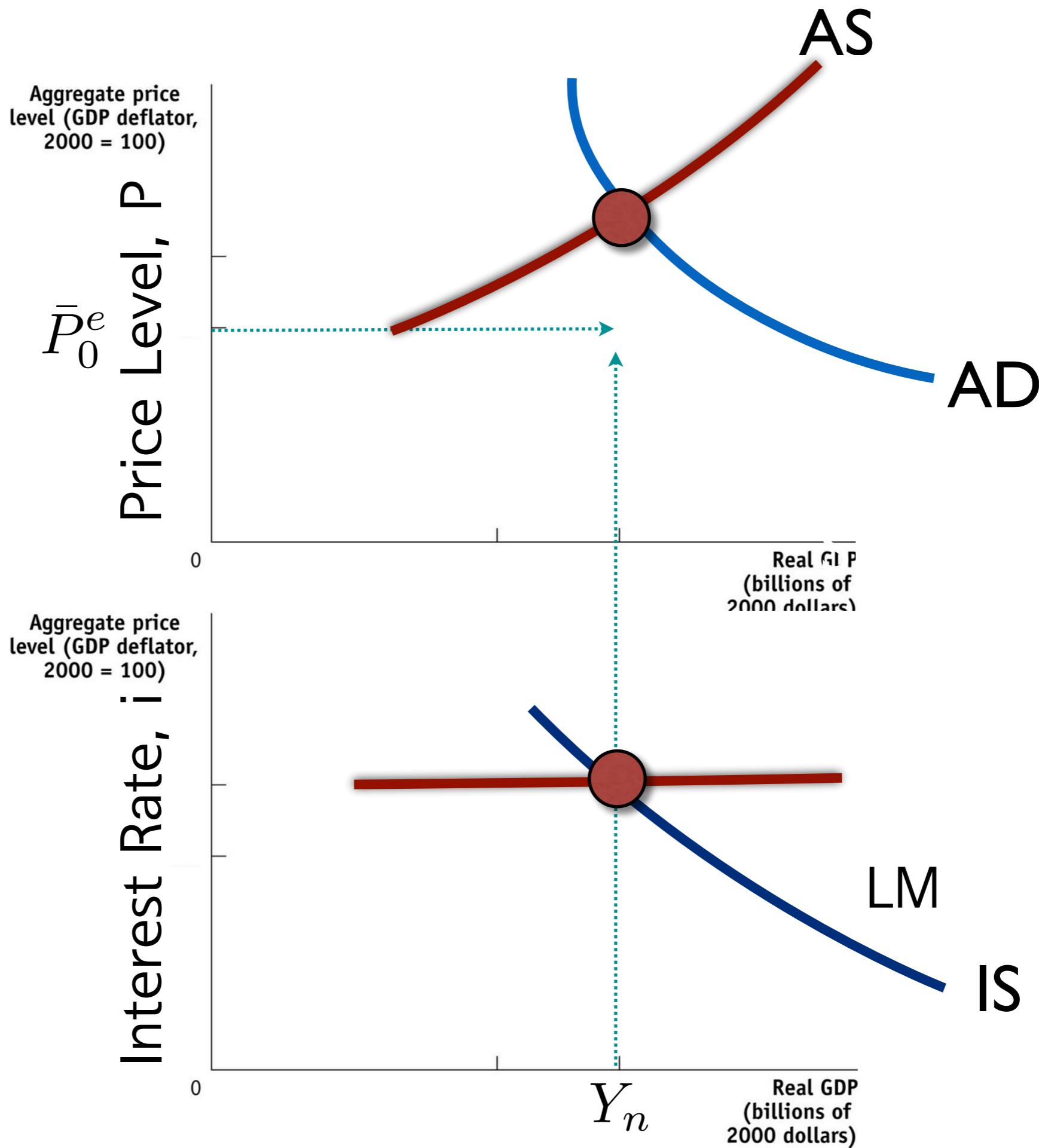
# 확장 재정정책의 동학



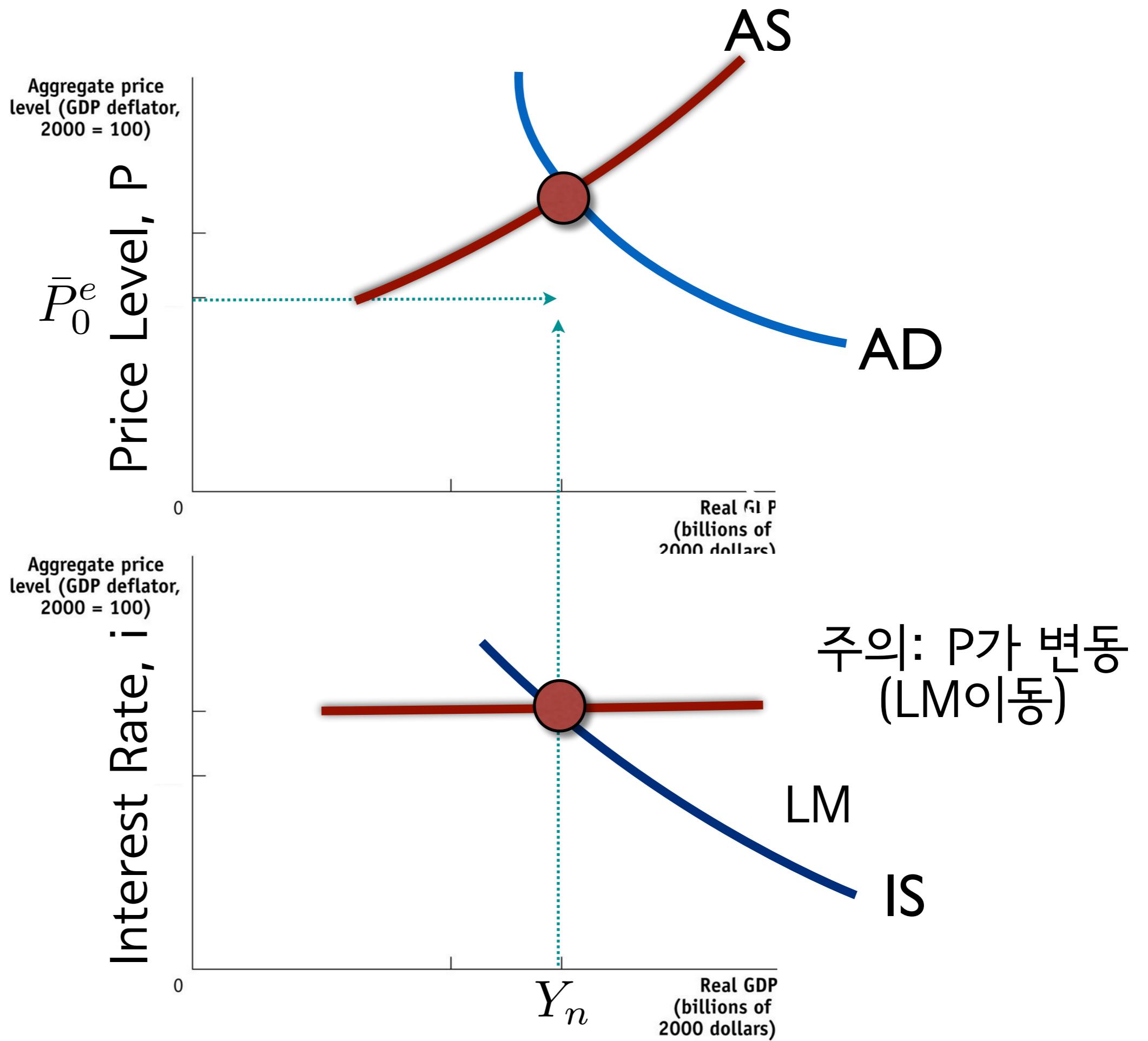
# 확장 재정정책의 동학



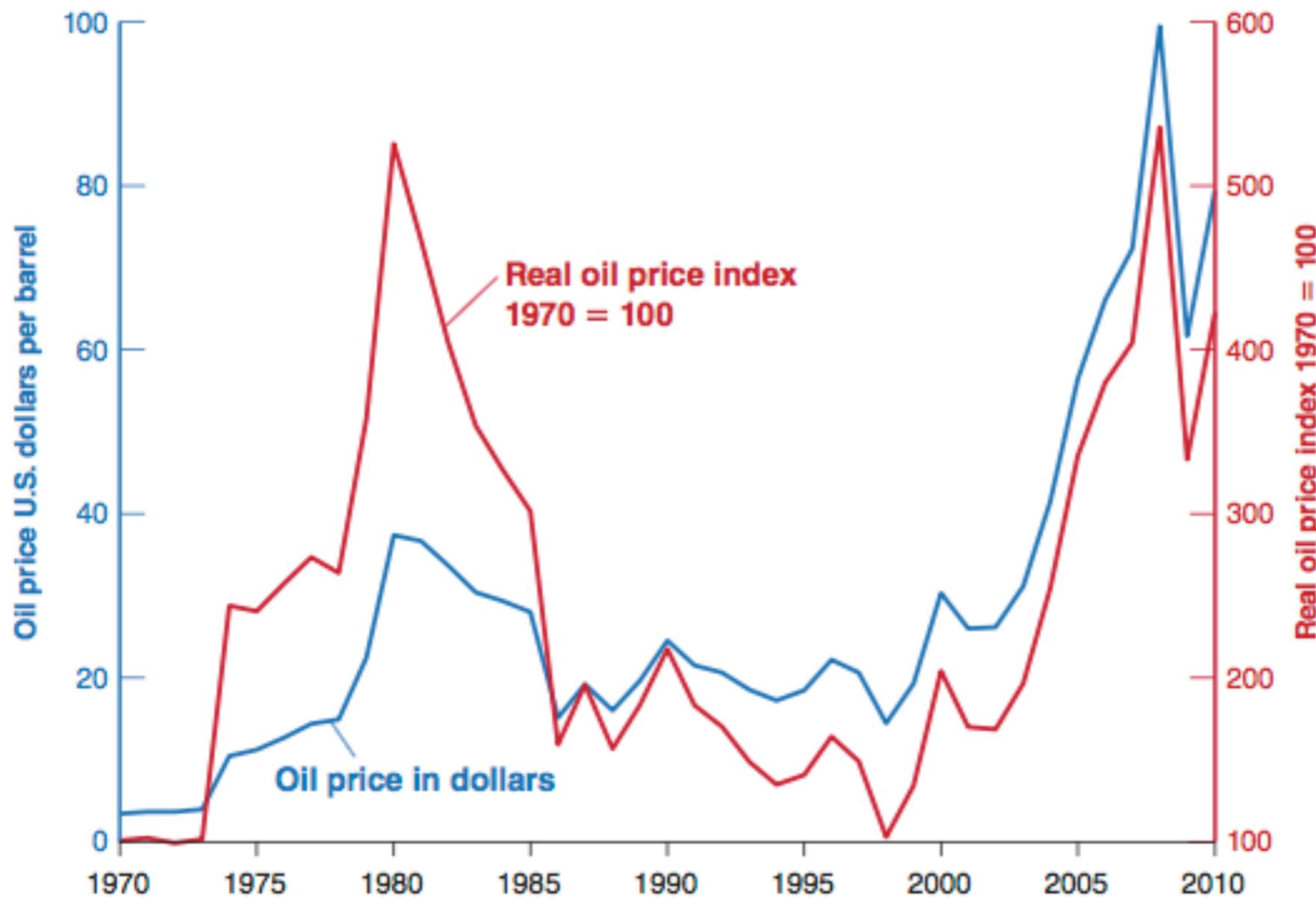
# 확장 재정정책의 동학



# 확장 재정정책의 동학



# Case Study: 국제유가 상승의 영향



**Figure 7-11**

*The Nominal and the Real Price of Oil, 1970–2010*

Over the last 40 years, there have been three sharp increases in the real price of oil. The first two increases took place in the 1970s. The more recent one took place in the 2000s, until the crisis hit.

Source: Series OILPRICE, CPIAUSCL Federal Reserve Economic Data (FRED) <http://research.stlouisfed.org/fred2/>. The value of the index is set equal to 100 in 1970.)

# Case Study: 국제유가 상승의 영향

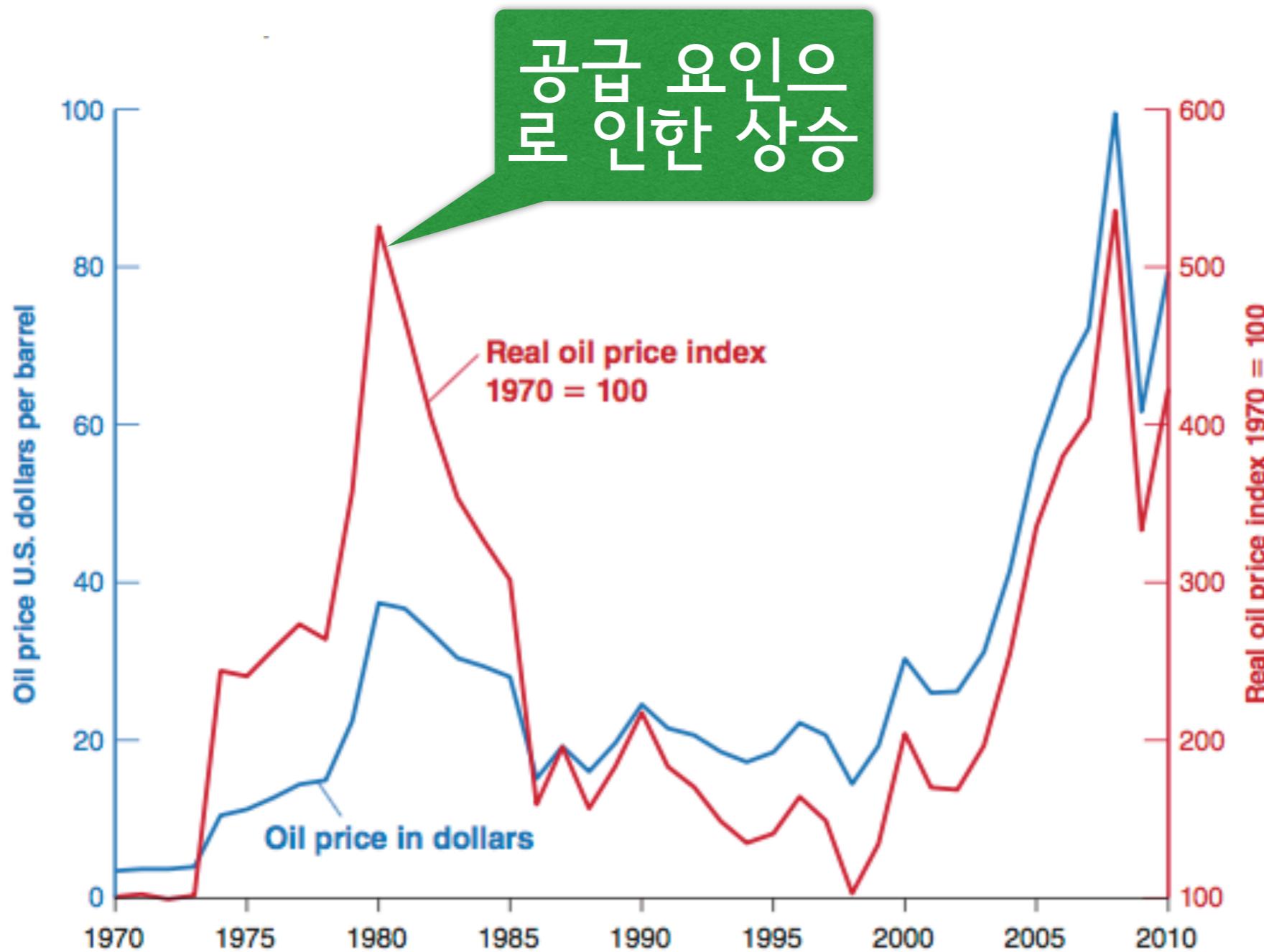


Figure 7-11

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# Case Study: 국제유가 상승의 영향

수요 요인으로 인한 상승

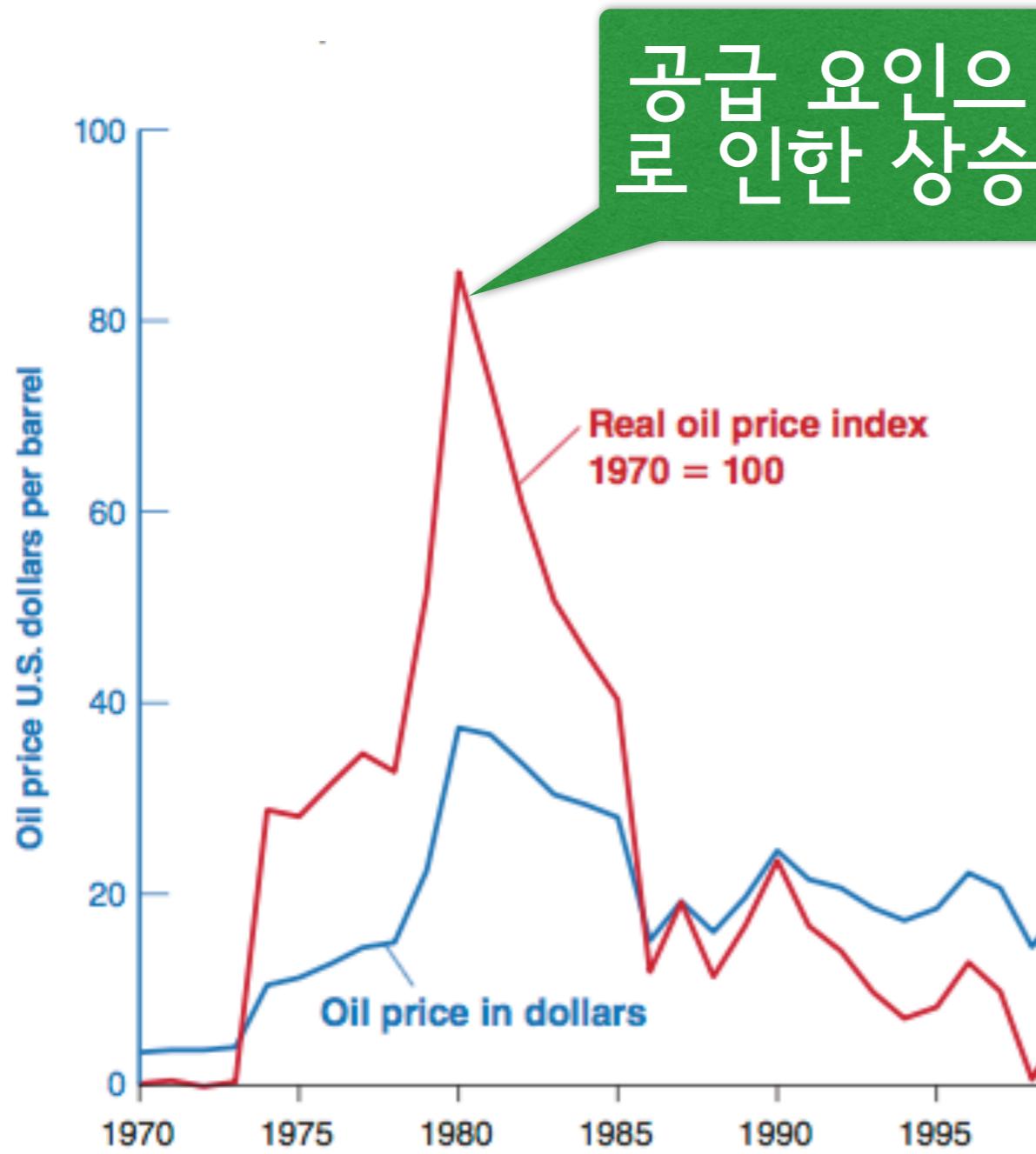


Figure 7-11

## *The Nominal and the Real Price of Oil, 1970–2010*

Over the last 40 years, there have been three sharp increases in the real price of oil. The first two increases took place in the 1970s. The more recent one took place in the 2000s, until the crisis hit.

Source: Series OILPRICE, CPIAUSCL Federal Reserve Economic Data (FRED) <http://research.stlouisfed.org/fred2/>. The value of the index is set equal to 100 in 1970.)

# Oil Price 상승의 해석

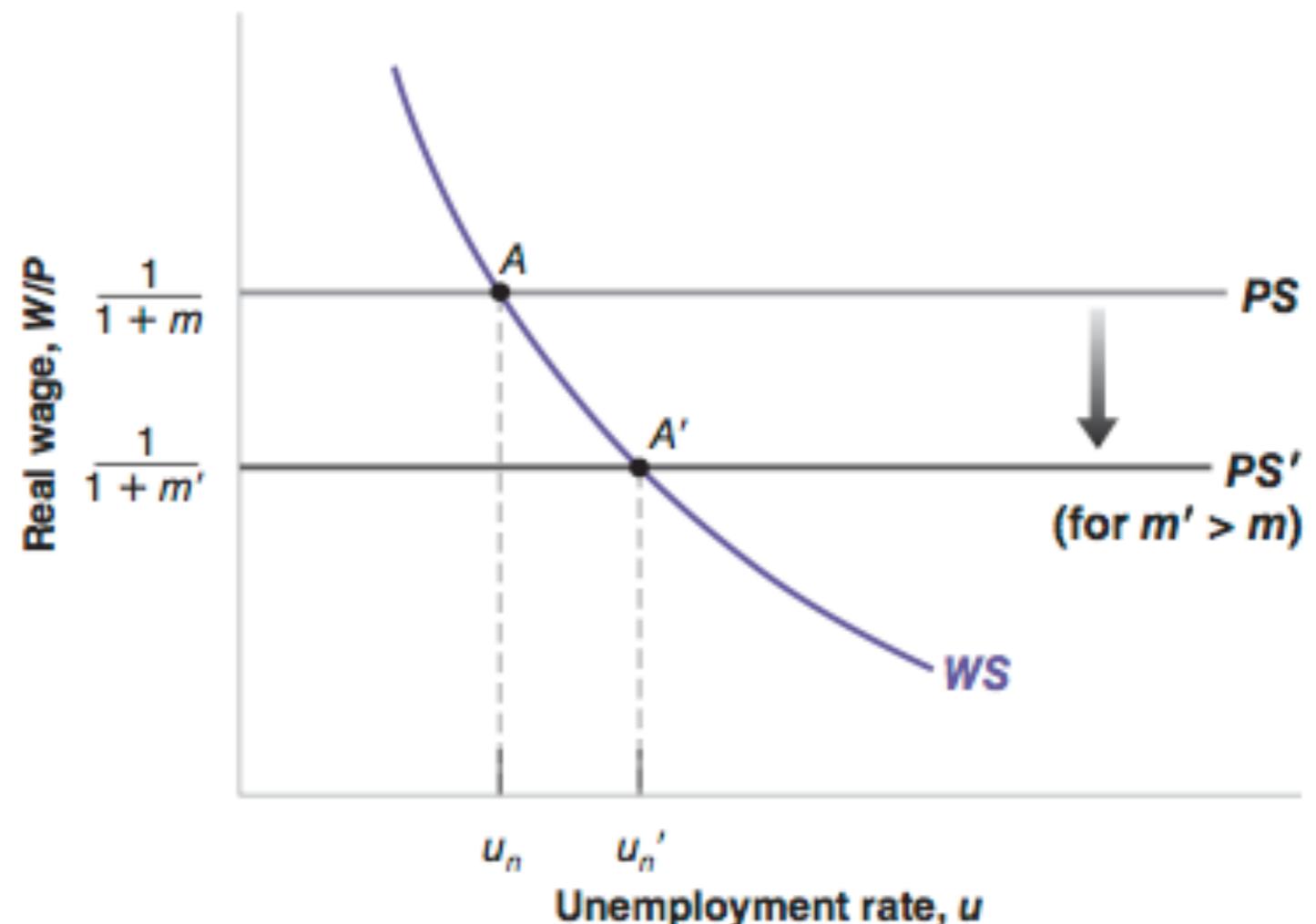
- 모형내 변수가 아님  $\Rightarrow$  어떤 변수에 영향을 미치는지 검토해야함
- 석유는 매우 보편적으로 사용되기 때문에 영향을 미치는 채널이 매우 많음
  - 여기에서는 markup rate 의 증가로 해석
  - $\Delta m > 0$

유가상승  
⇒ 자연실업률 증가

Figure 7-12

*The Effects of an Increase  
in the Price of Oil on  
the Natural Rate of  
Unemployment*

An increase in the price of oil leads to a lower real wage and a higher natural rate of unemployment.



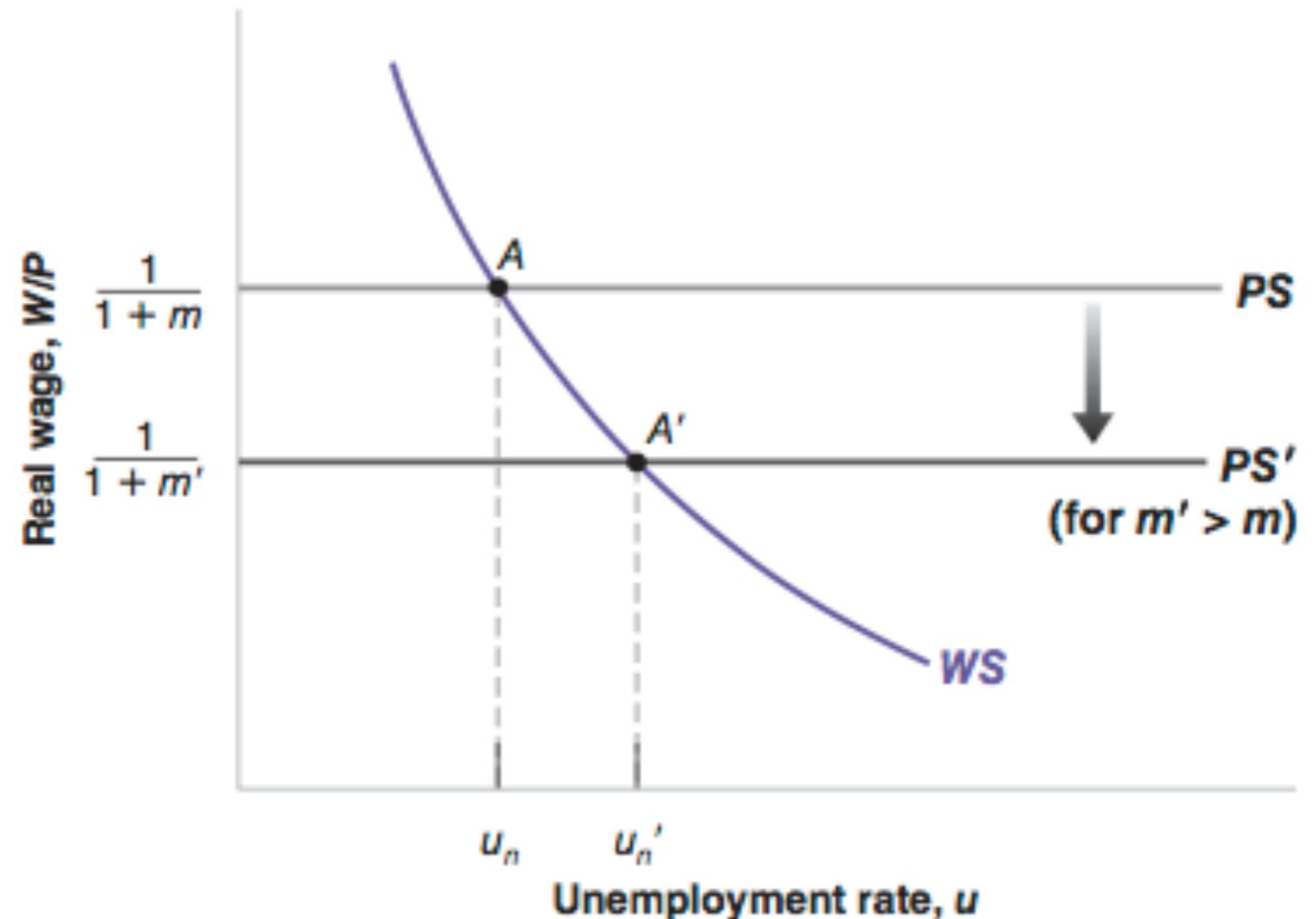
# 유가상승 ⇒ 자연실업률 증가

주의: 일시적인 경우 효과 제한적

**Figure 7-12**

*The Effects of an Increase  
in the Price of Oil on  
the Natural Rate of  
Unemployment*

An increase in the price of oil leads to a lower real wage and a higher natural rate of unemployment.



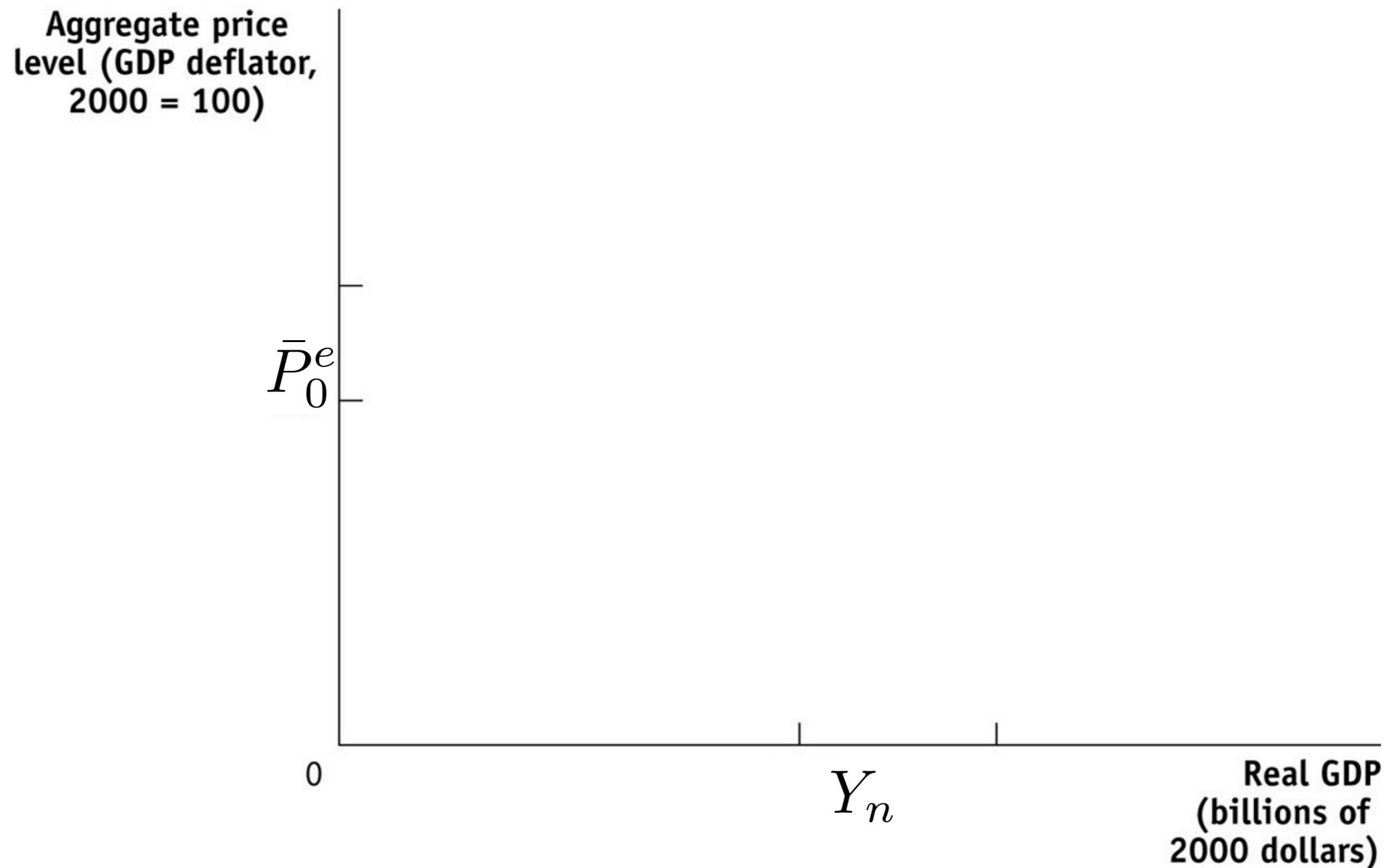
# 유가상승 = Negative AS Shock

$$P = \bar{P}^e(1 + \bar{m})F \left( 1 - \frac{Y}{\bar{A}\bar{L}}, \bar{z}_+ \right)$$

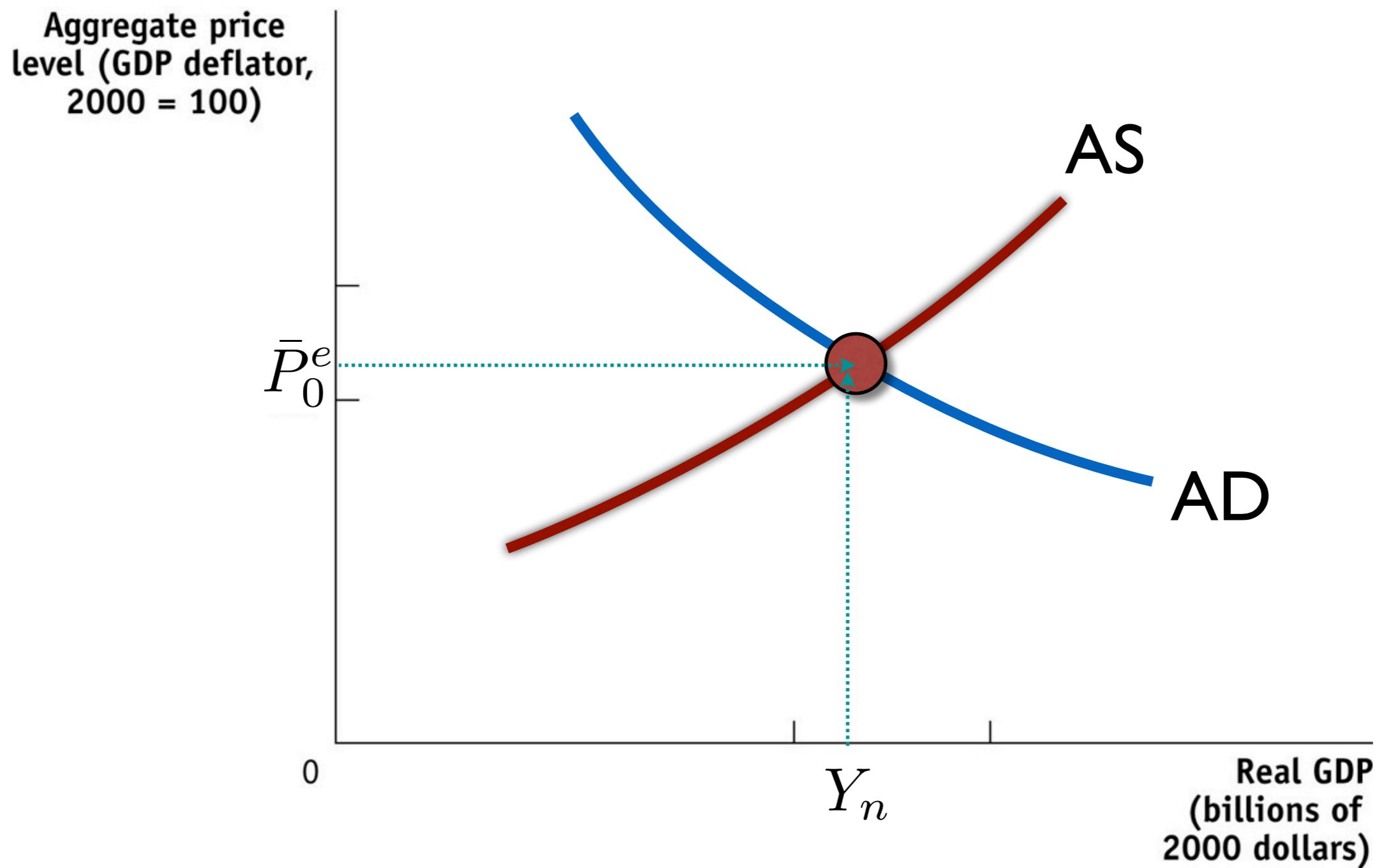
$$Y = Y(\tilde{M}/P, \tilde{G}_+, \tilde{T}_-)$$

- AS:  $m$ 이 증가  $\Rightarrow$  AS 상방이동
- AD: 복합적: 다양한 요인이 상쇄되어 전체적으로는 큰 변화가 없는 것으로 가정.
- 실증적으로 심각한 오류가 아님을 확인 가능.

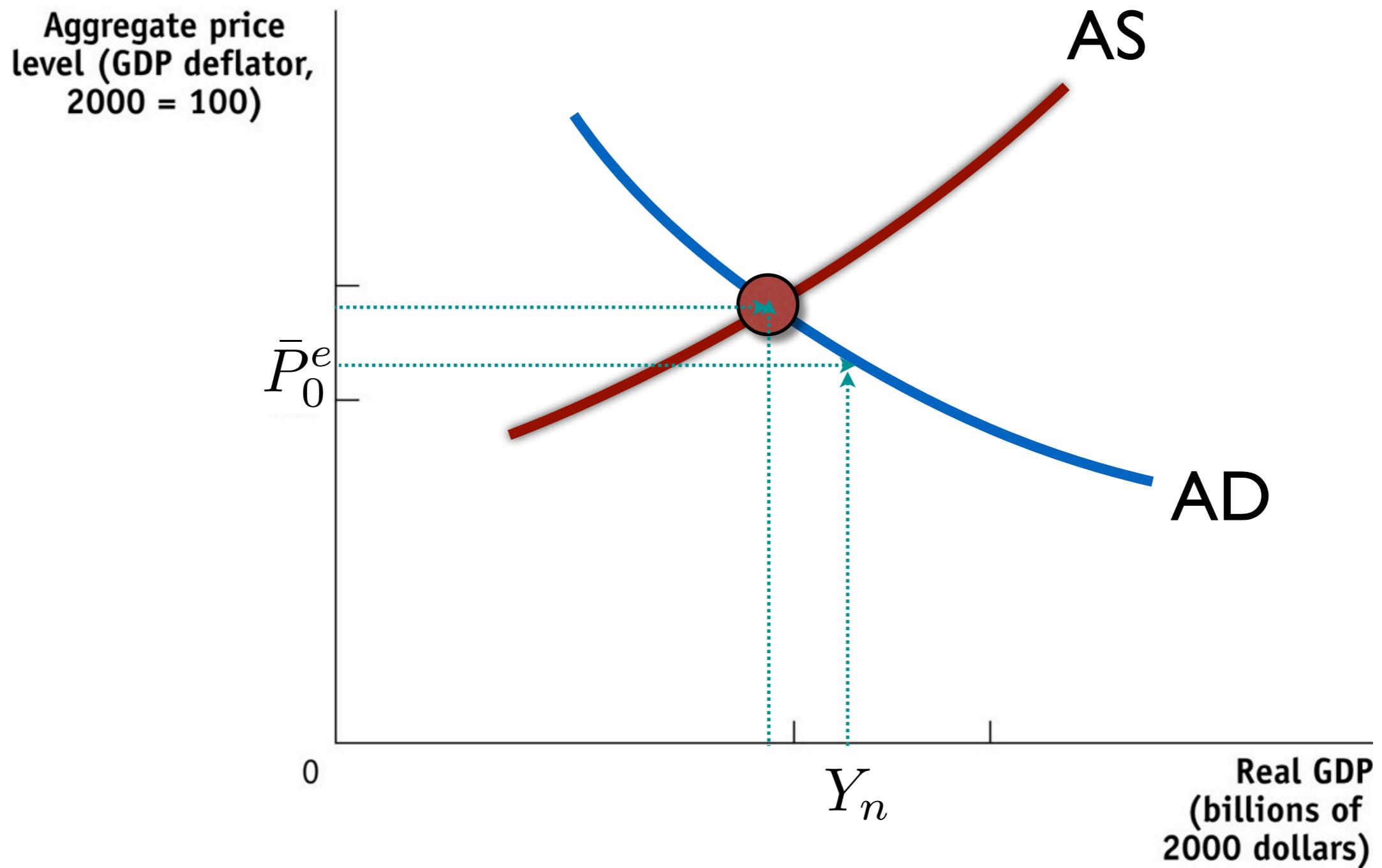
# (장기에 걸친) 유가상승 (AS shock): Stagflation



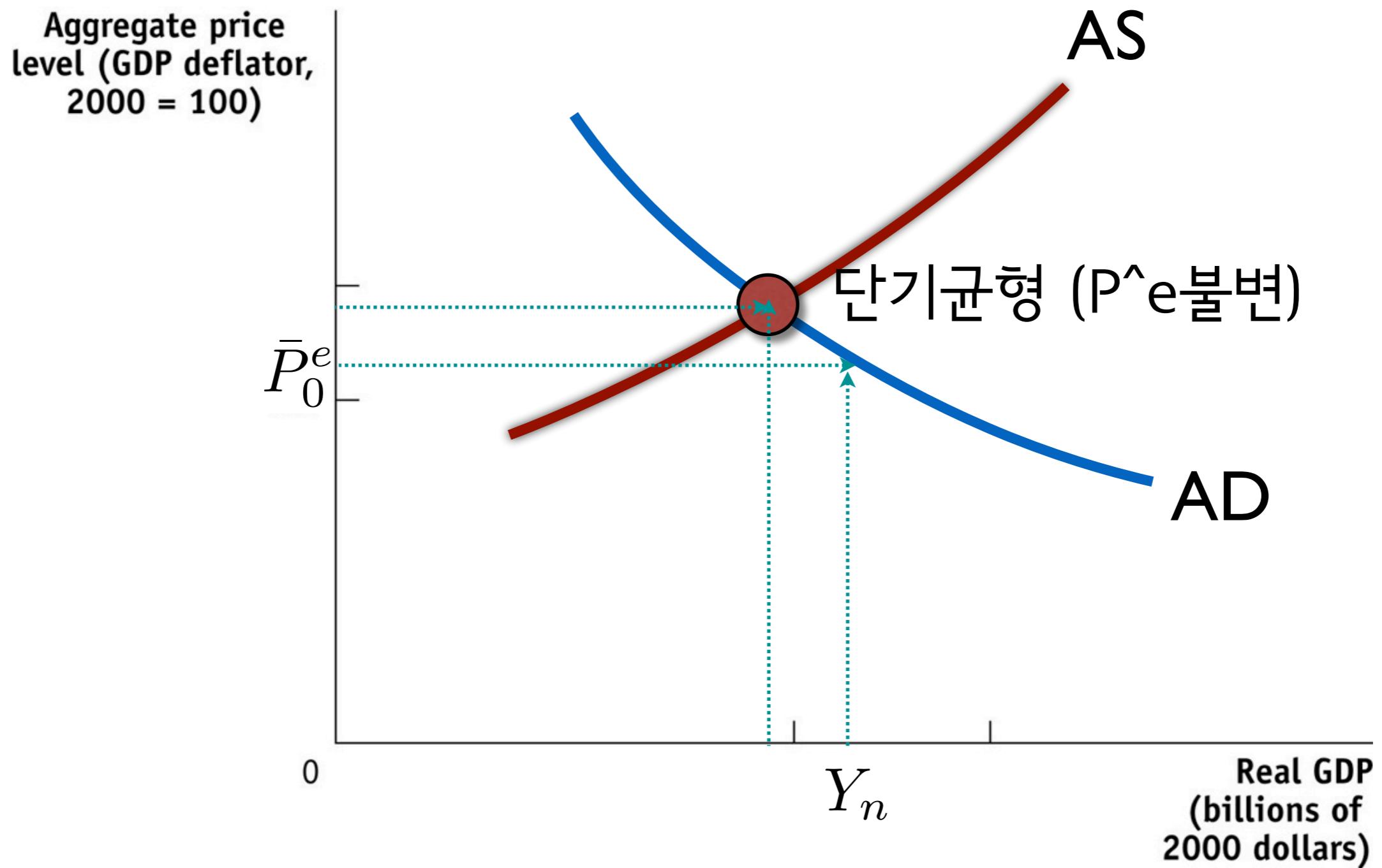
# (장기에 걸친) 유가상승 (AS shock): Stagflation



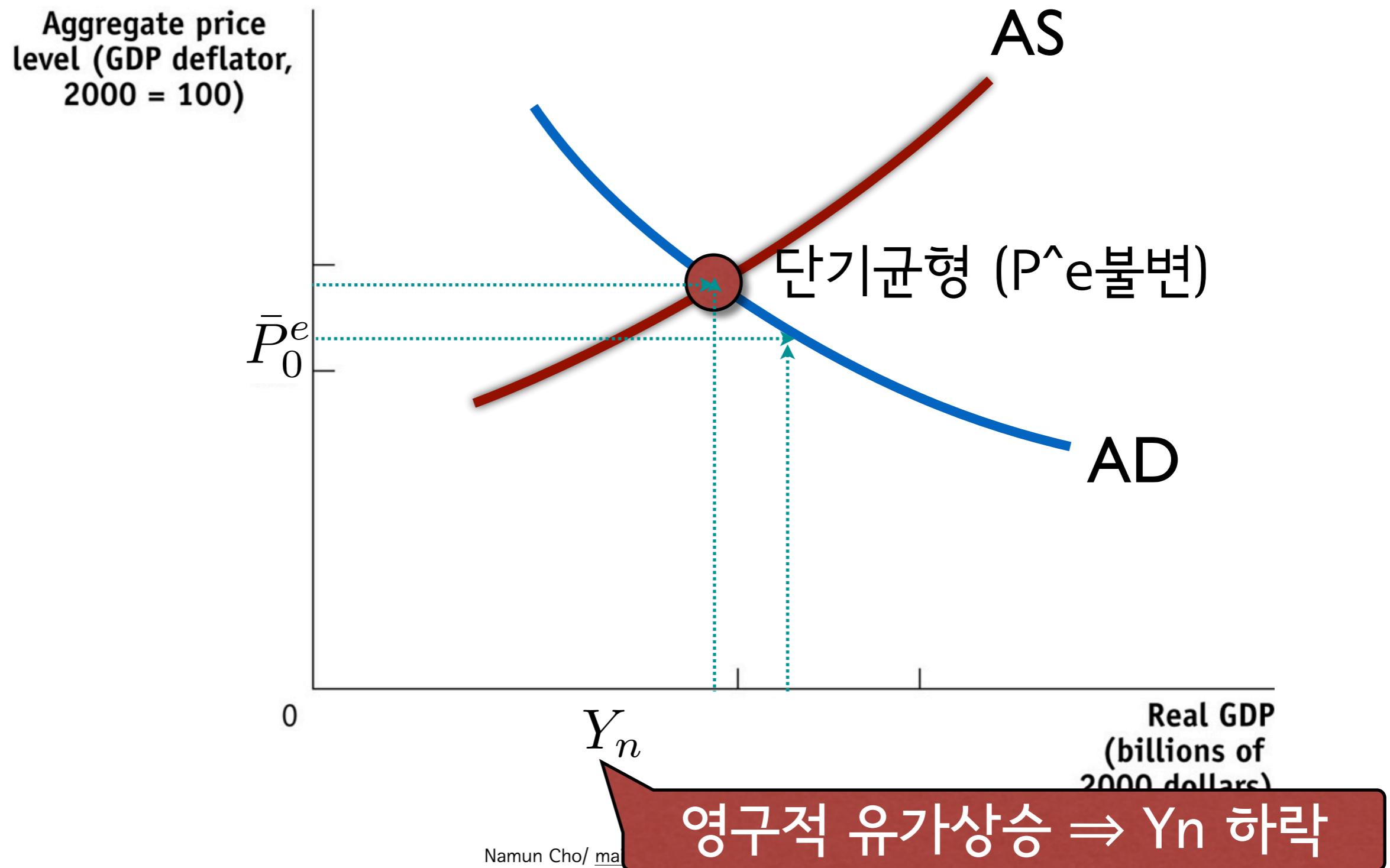
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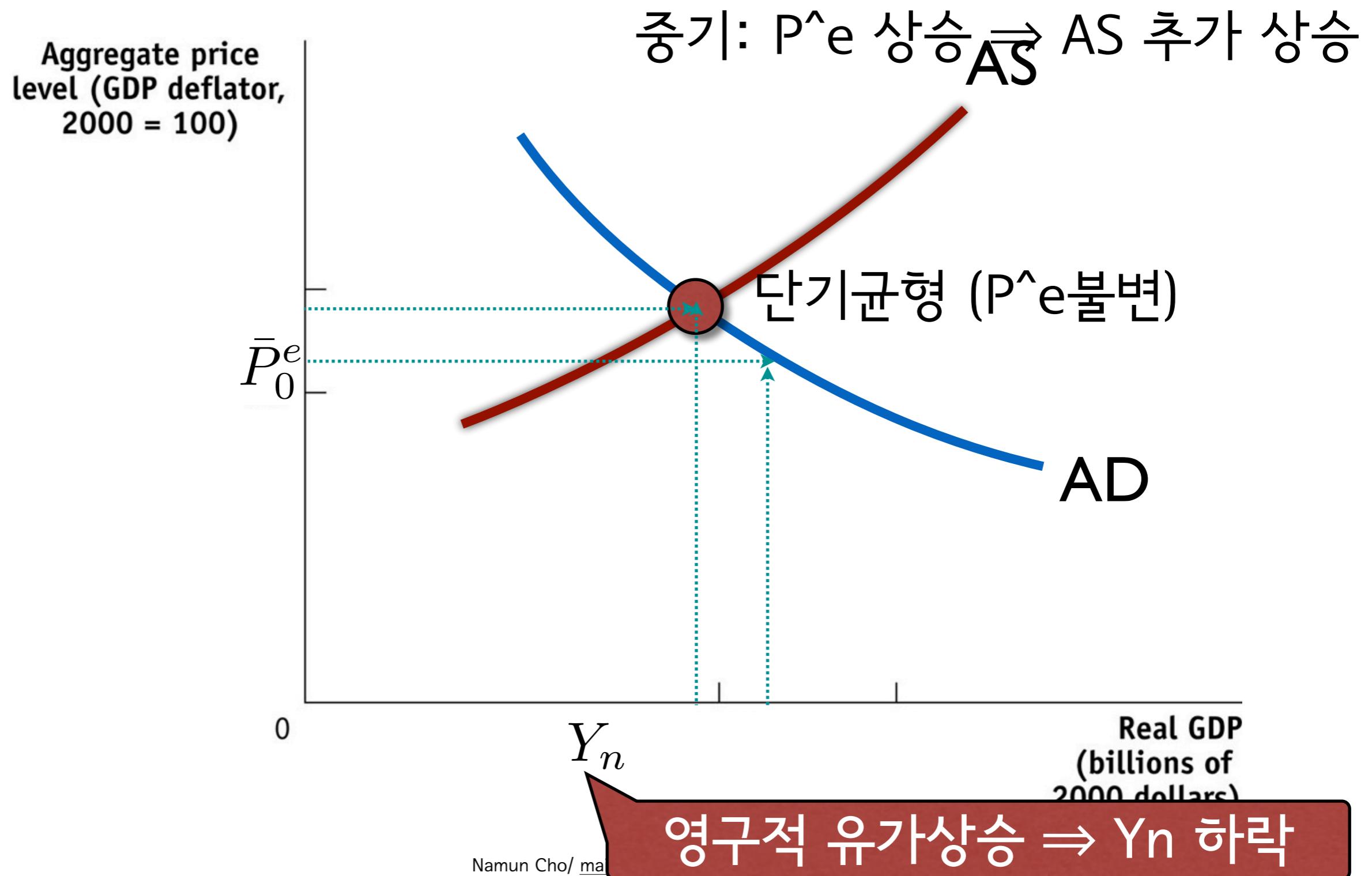
# (장기에 걸친) 유가상승 (AS shock): Stagflation



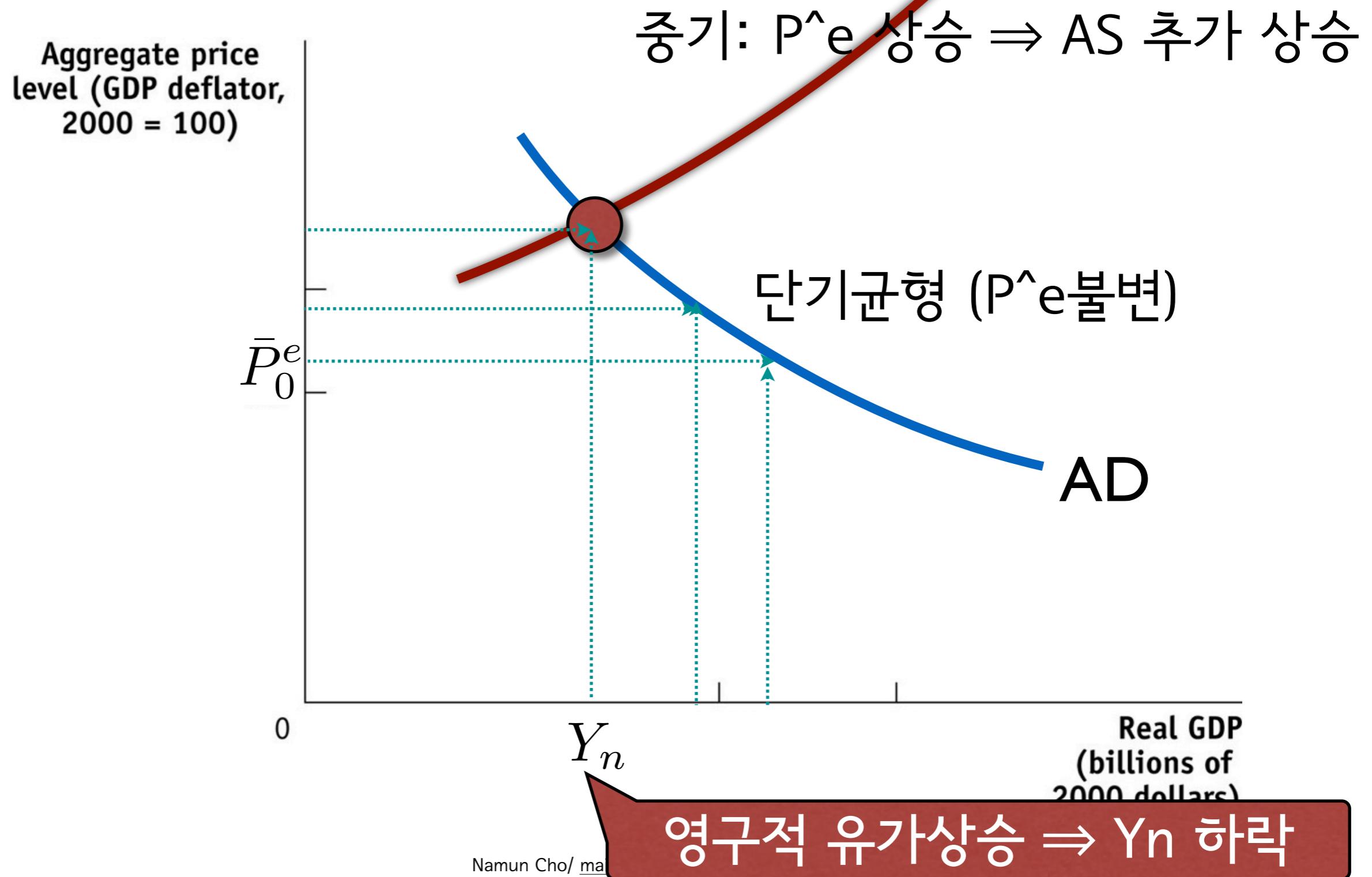
# (장기에 걸친) 유가상승 (AS shock): Stagflation



# (장기에 걸친) 유가상승 (AS shock): Stagflation



# (장기에 걸친) 유가상승 (AS shock): Stagflation



# **IS-LM-PC Model**

7ed Ch.9

# 전통적 해석과 다른 관점

- 중앙은행의 행태를 Natural Rate (경기 중립적 상태) 유지로 해석
- Zero lower bound를 적극적으로 모형에 반영하려 함

# IS-LM-PC Model

$$Y = C(Y - \tilde{T}) + I(Y_+, \underbrace{\tilde{r} + x}_{+}) + \tilde{G}$$
$$\pi_t - \pi_t^e = -\bar{\alpha} (u_t - \bar{u}_n)$$

- IS-LM : 단기 균형
  - $r - Y$  공간
- PC: 중기에 가격 조정 과정을 통해 조정
  - 가로축을 일치시키기 위해  $u$  대신  $Y$ 를 사용
  - $\Delta\pi - Y$  공간

$$u \equiv \frac{U}{L} = \frac{L - N}{L} = 1 - \frac{N}{L} = 1 - \frac{Y}{\bar{A}L}$$

# Y로 나타낸 필립스곡선

$$u \equiv \frac{U}{L} = \frac{L - N}{L} = 1 - \frac{N}{L} = 1 - \frac{Y}{\bar{A}L}$$

$$Y = AL(1 - u)$$

$$u_n \equiv \frac{U_n}{L} = \frac{L - N_n}{L} = 1 - \frac{N_n}{L} = 1 - \frac{Y_n}{\bar{A}L}$$

$$Y_n = AL(1 - u_n)$$

$$Y - Y_n = -AL(u - u_n)$$

$$\pi_t - \pi_t^e = -\bar{\alpha} (u_t - \bar{u}_n)$$

$$\pi_t - \pi_t^e = \frac{\bar{\alpha}}{\bar{A}L} \underbrace{(Y_t - Y_n)}_{\text{Output Gap}}$$

# Okun's Law

$$u \equiv \frac{U}{L} = \frac{L - N}{L} = 1 - \frac{N}{L} = 1 - \frac{Y}{\bar{A}L}$$

- Assume  $A=1$
- $X[-1]$  : 1기 전  $X$ 의 값
- GDP 성장률 =  $\Delta Y/Y = (Y - Y[-1])/Y[-1] \approx (N - N[-1])/N[-1] = -L/N[-1] \Delta u$
- $L/N \approx 1$  이므로 GDP성장률과  $\Delta u$ 는 -1 정도의 비율을 가지고 있어야 함. (일대일 대응)
- 하지만 실제 관측 결과는 다름: -1이 아니라 -0.4: Okun coefficient

$$u - u(-1) = -0.4(g_Y - 3\%) \quad (9B.2)$$

# Okun's Law의 의미

- 3%: 인구성장+생산성성장
- 0.4: 총생산 1%p 증가[감소]가 고용 1%p 증가[감소]가 아닌, 더 적은 비율의 고용량 변화로 작동한다는 것을 의미
- 기업은 단기적인 작은 변화에 대해서는 고용변화보다는 가동율로 대응
- 구직포기자/신규구직자의 존재: 실업률의 분모에 해당하는 구직자의 수 자체가 경기에 따라 변화

$$u - u(-1) = -0.4(g_Y - 3\%) \quad (9B.2)$$

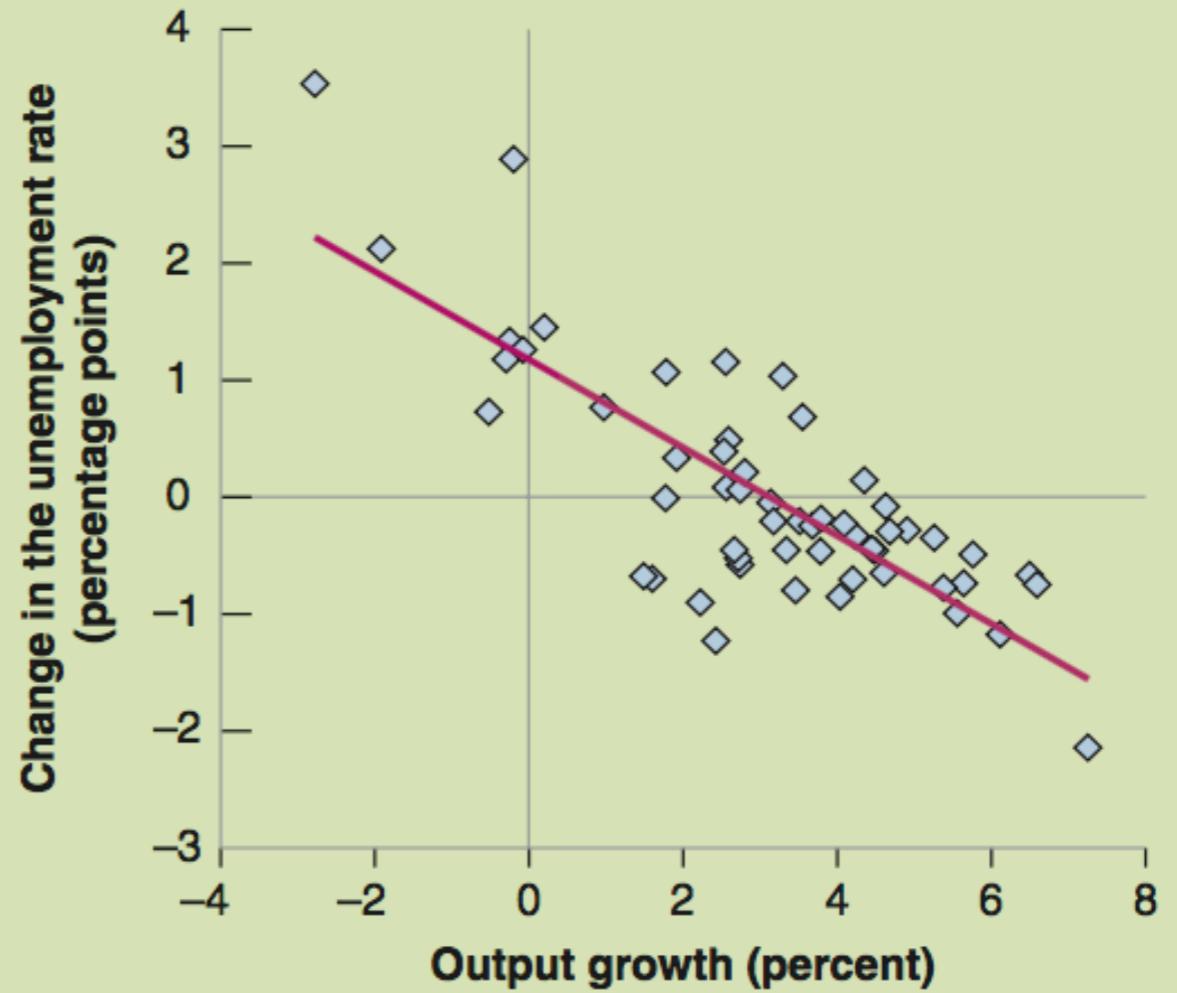
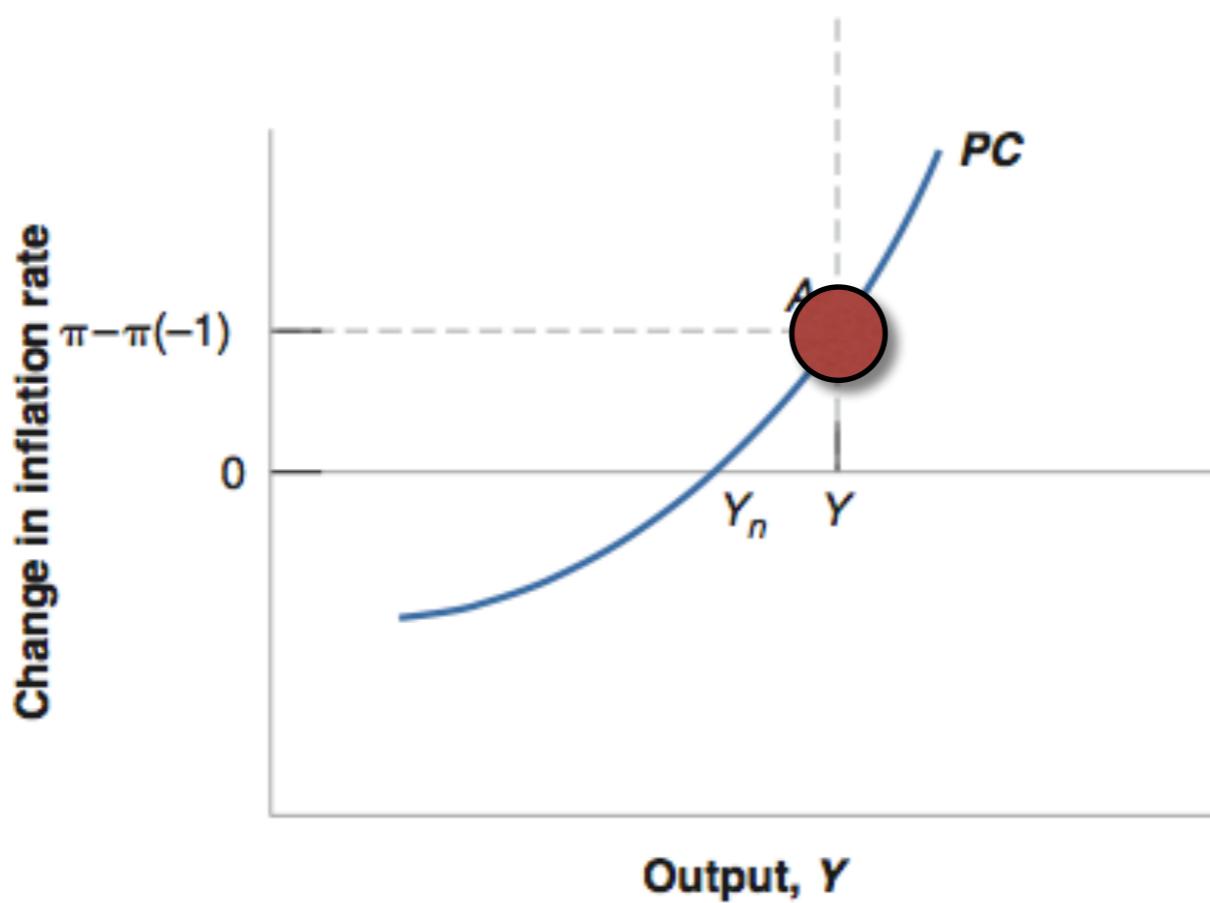
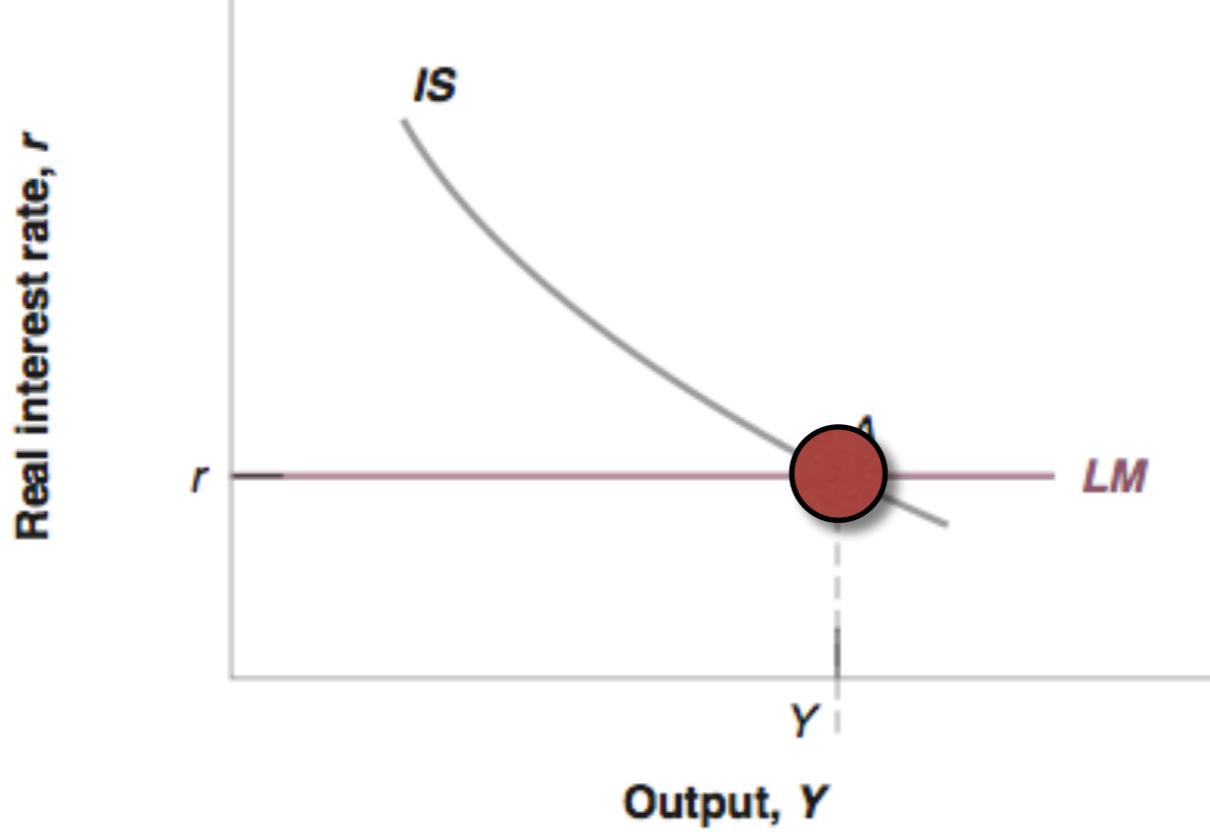
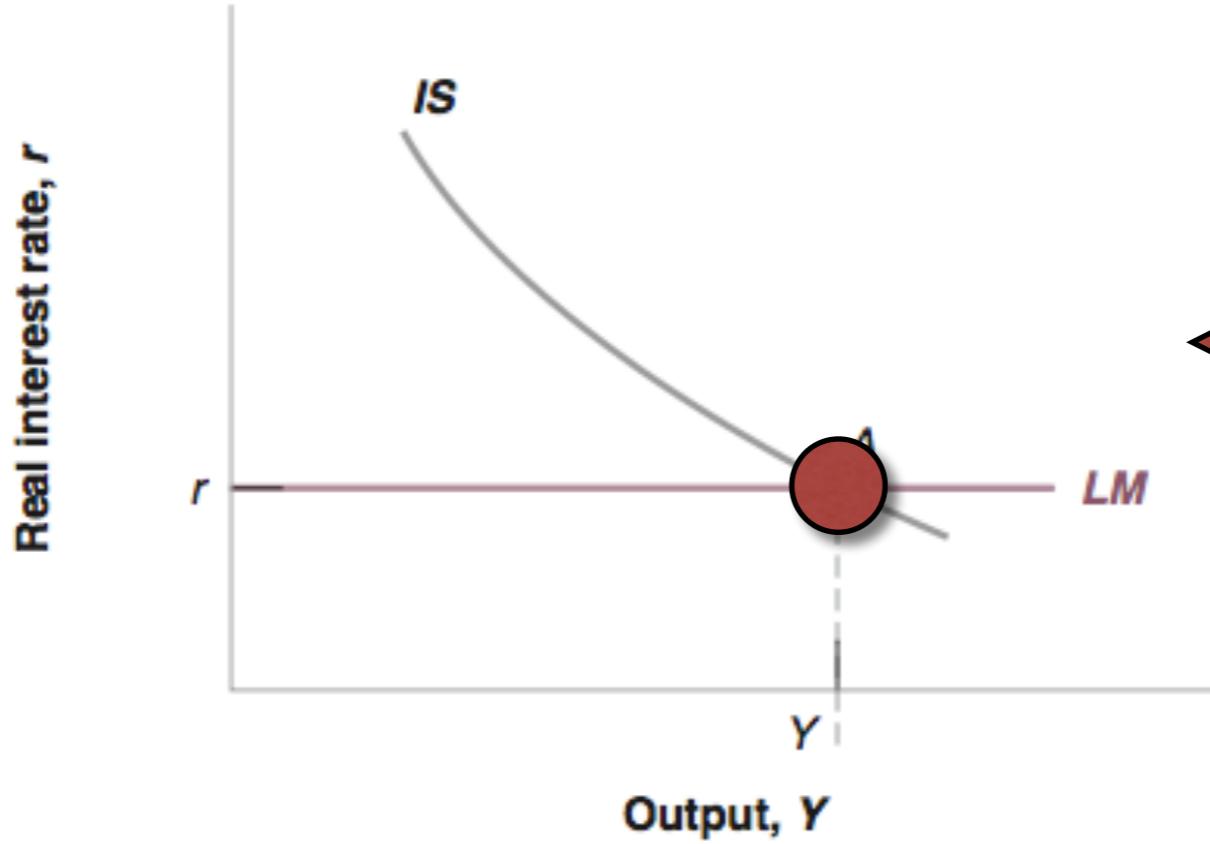


Figure 1 Changes in the Unemployment Rate versus Output Growth in the United States, 1960–2014

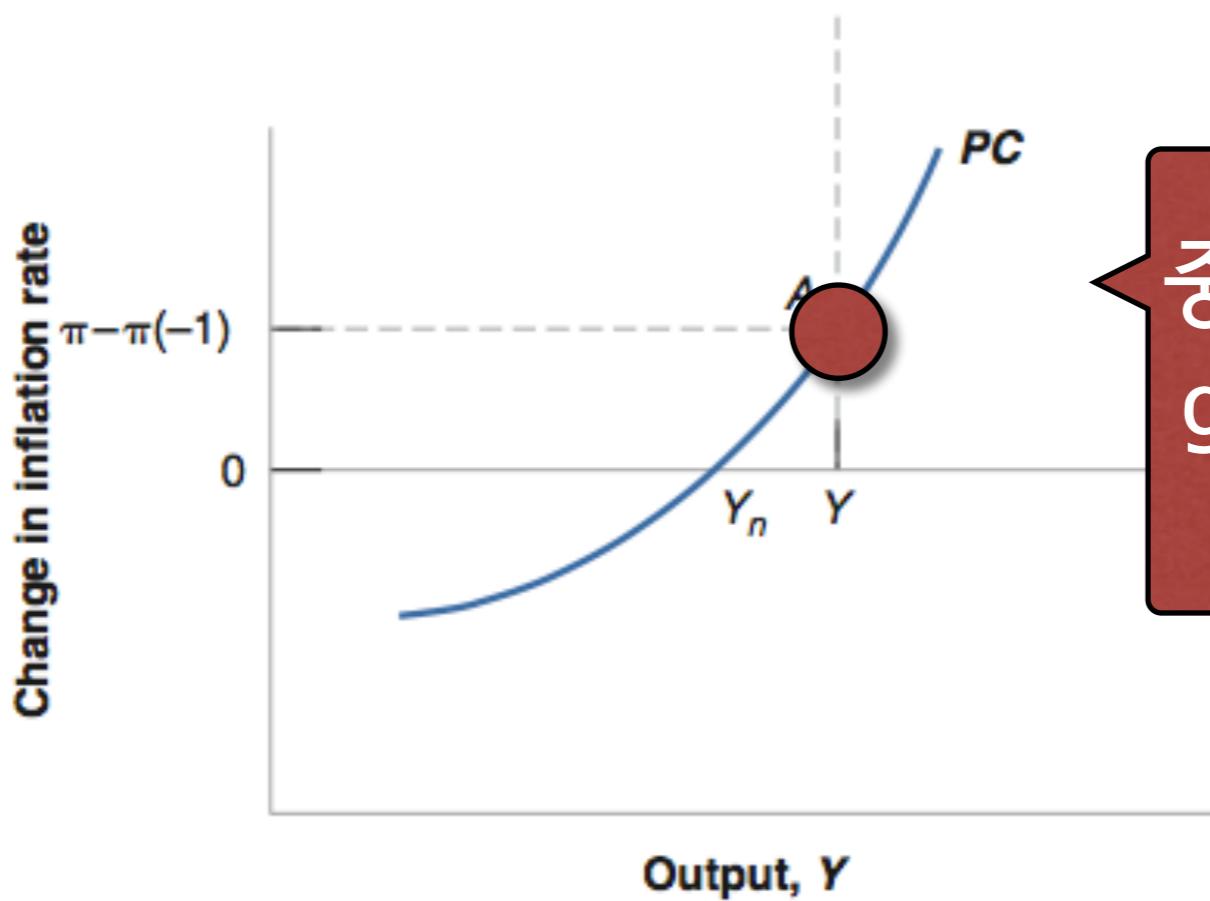
서로 측이  $\pi - \hat{\pi}^e$   
임에 유의할 것



서로 측이  $\pi - \pi^e$   
임에 유의한 것

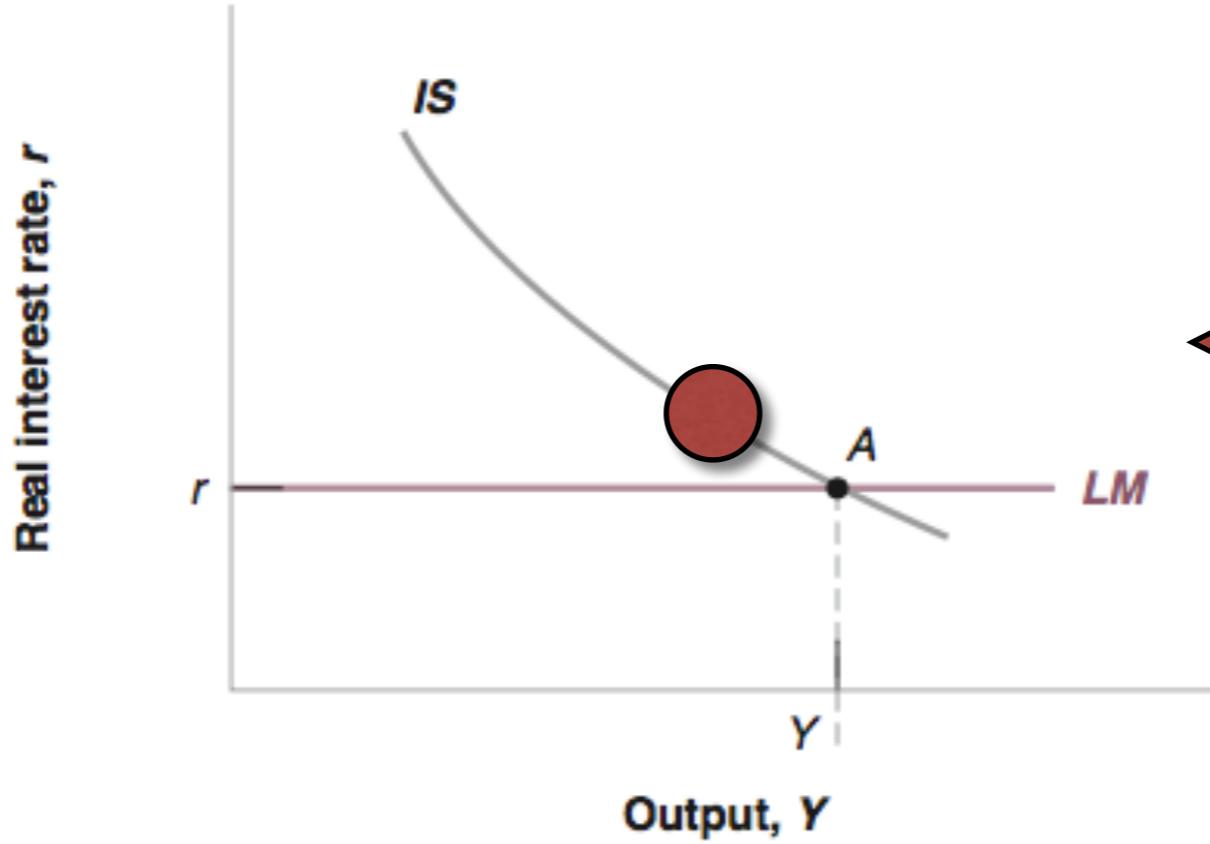


중기: 인플레이션을 잡기 위해  
기준금리 인상

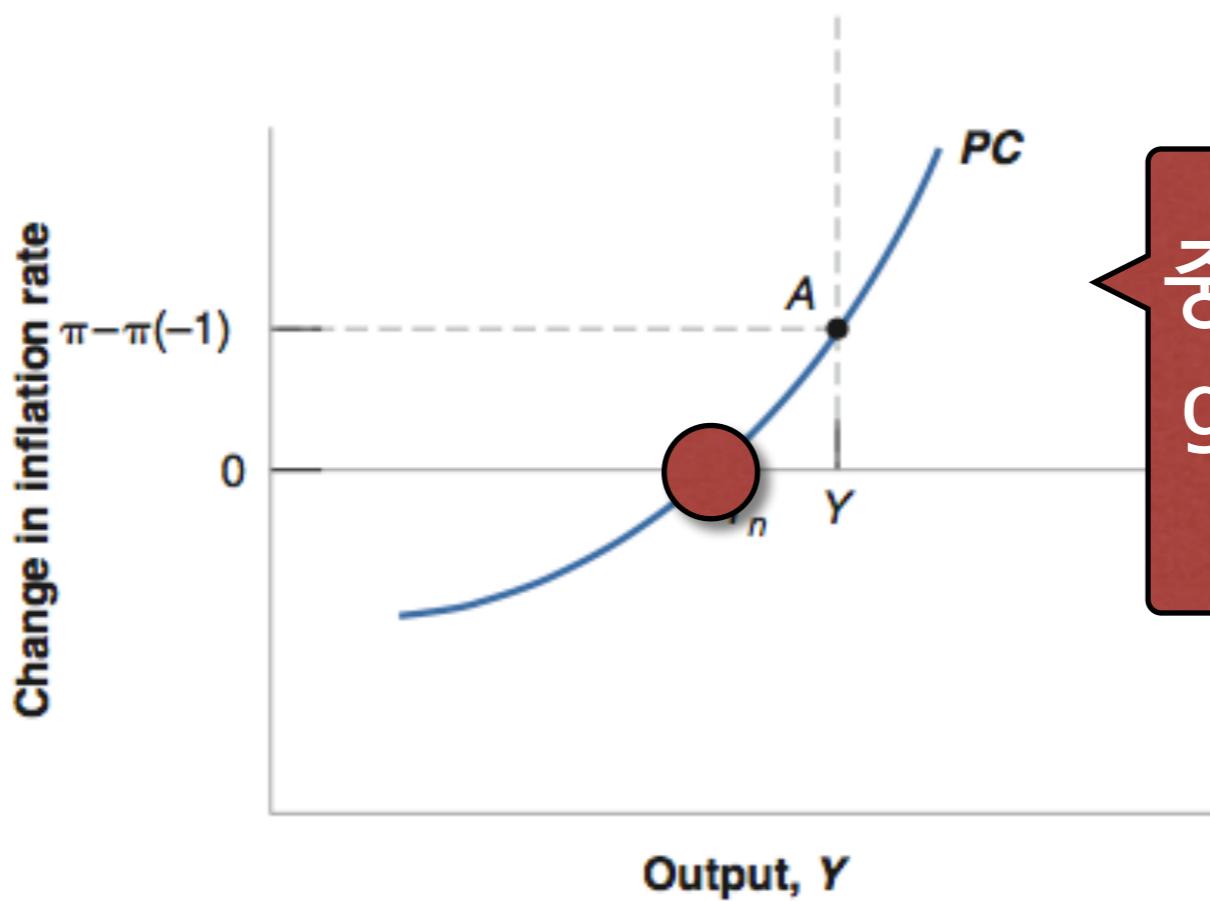


중기:  $\pi^e$  조정  $\Rightarrow$   
gap  $\rightarrow 0 \Rightarrow$  인플레이션 증가

서로 죽이  $\pi - \pi^e$   
임에 유익한 것

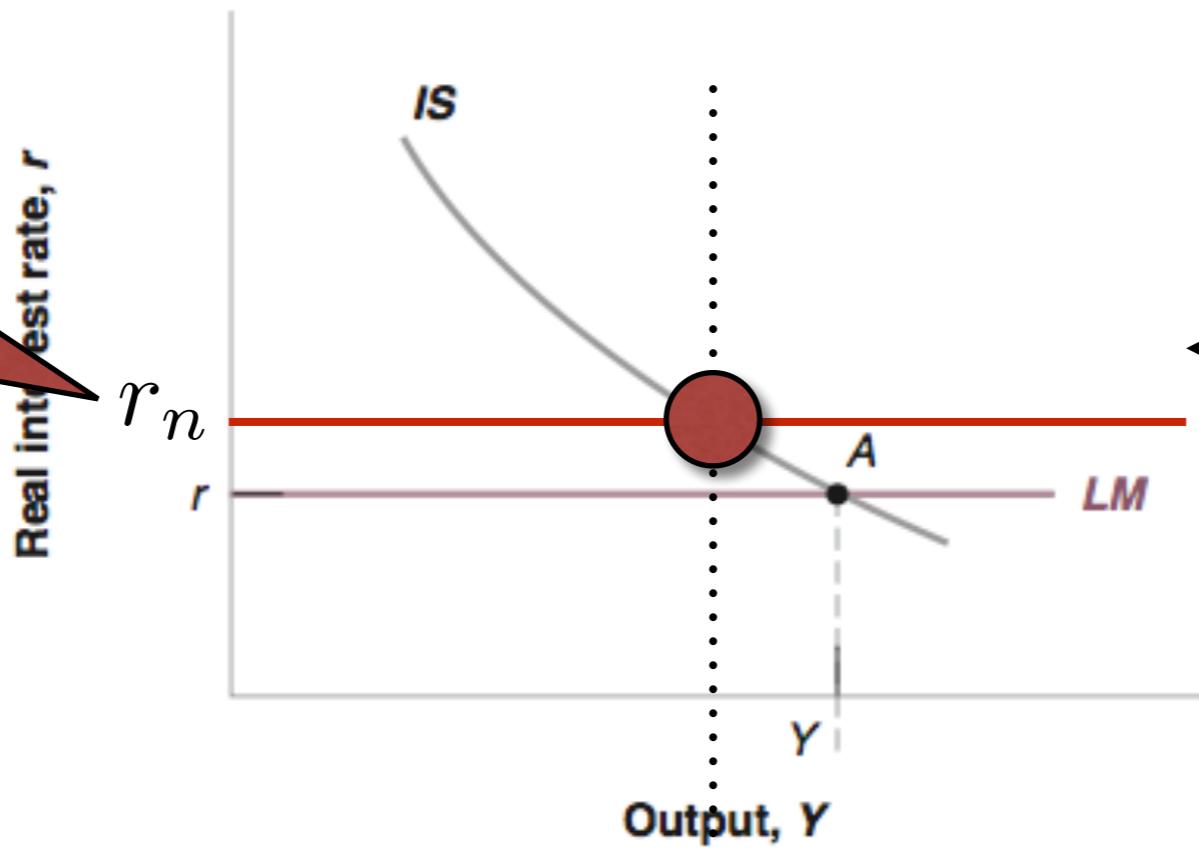


중기: 인플레이션을 잡기 위해  
기준금리 인상



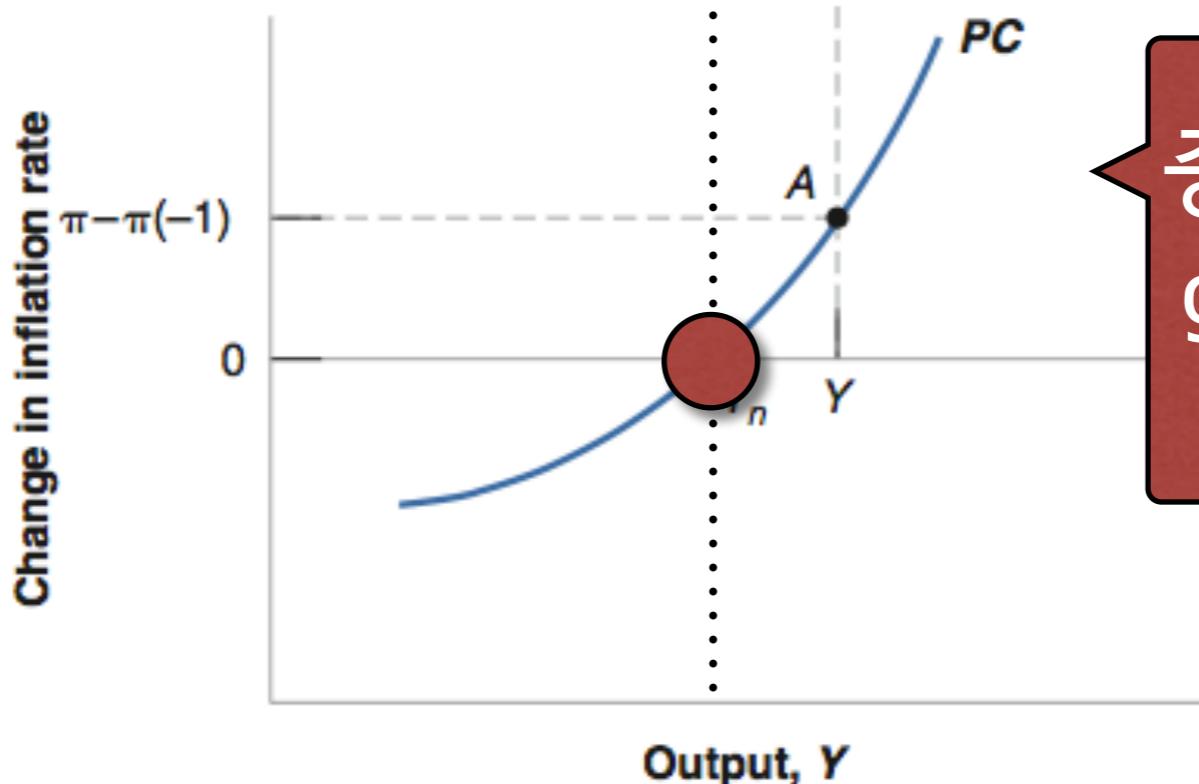
중기:  $\pi^e$  조정  $\Rightarrow$   
gap  $\rightarrow 0 \Rightarrow$  인플레이션 증가

Natural  
rate of  
interest



중기: 인플레이션을 잡기 위해 기준금리 인상

세로축이  $\pi - \pi^e$  입에 유익한 것



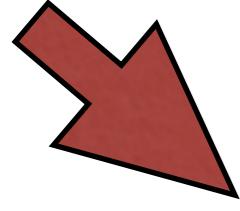
중기:  $\pi^e$  조정  $\Rightarrow$  gap  $\rightarrow 0 \Rightarrow$  인플레이션 증가

# 중앙은행의 행동

- 현대 중앙은행들의 목표는 두 가지임
  - 안정적인 인플레이션
  - 잠재총생산( $Y_n$ ) 정도의 총생산 유지
- 영원히  $Y > Y_n$  수준의 총생산을 유지하는 것은 추가적인 인플레이션을 발생시키지 않는 한 불가능 (화폐 중립성)
- 하지만  $Y_n$ ,  $r_n$  같은 값을 정확히 알기 힘듬
  - 정책금리를 미세조정하는 이유

# 필립스 고선

서로 축이  $\pi$  임에 유익할 것



# 풀립스 곡선

세로축이  $\pi$  임에 유익할 것

Inflation  
rate

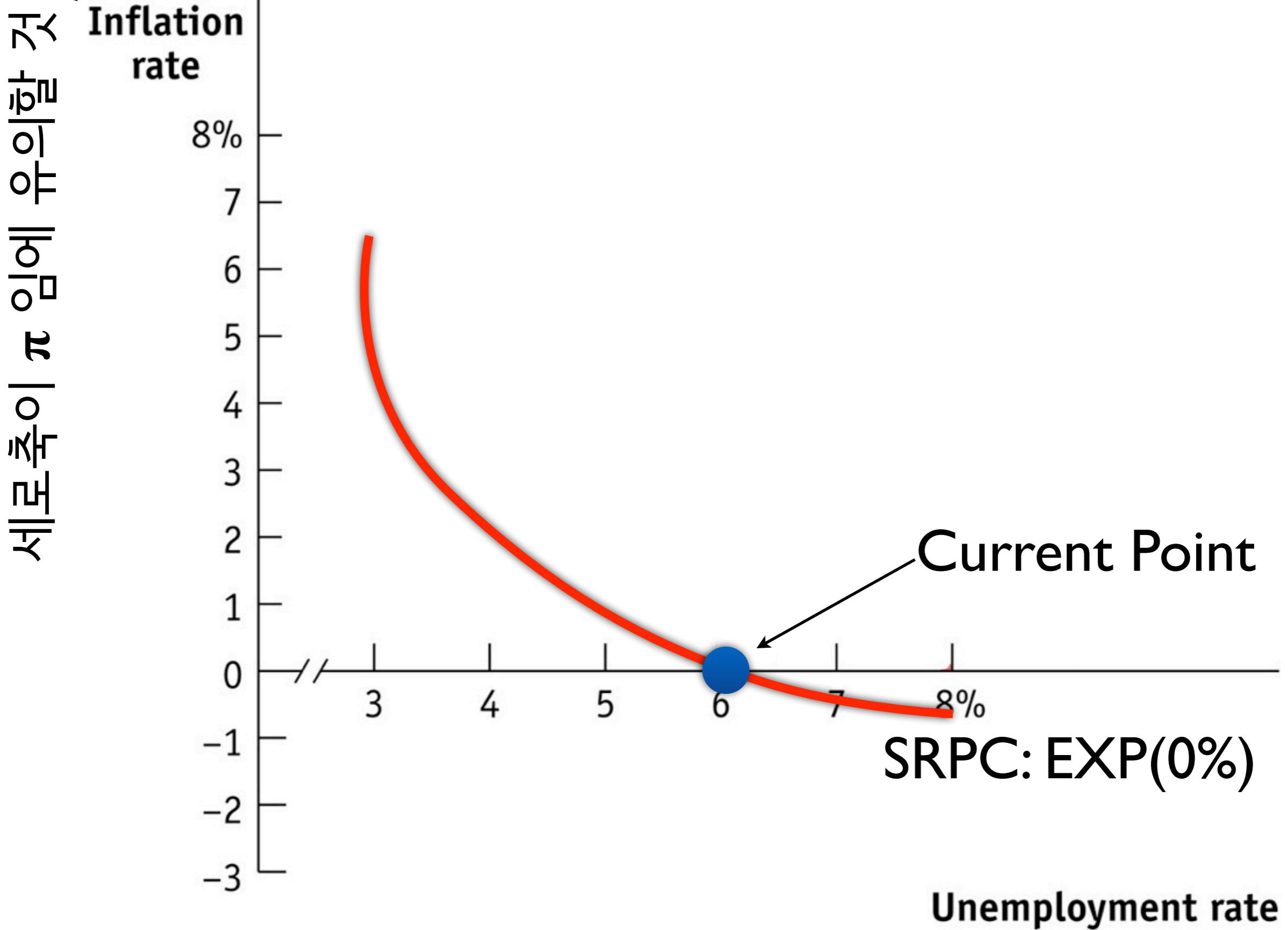
8%  
7  
6  
5  
4  
3  
2  
1  
0  
-1  
-2  
-3

3 4 5 6 7 8%

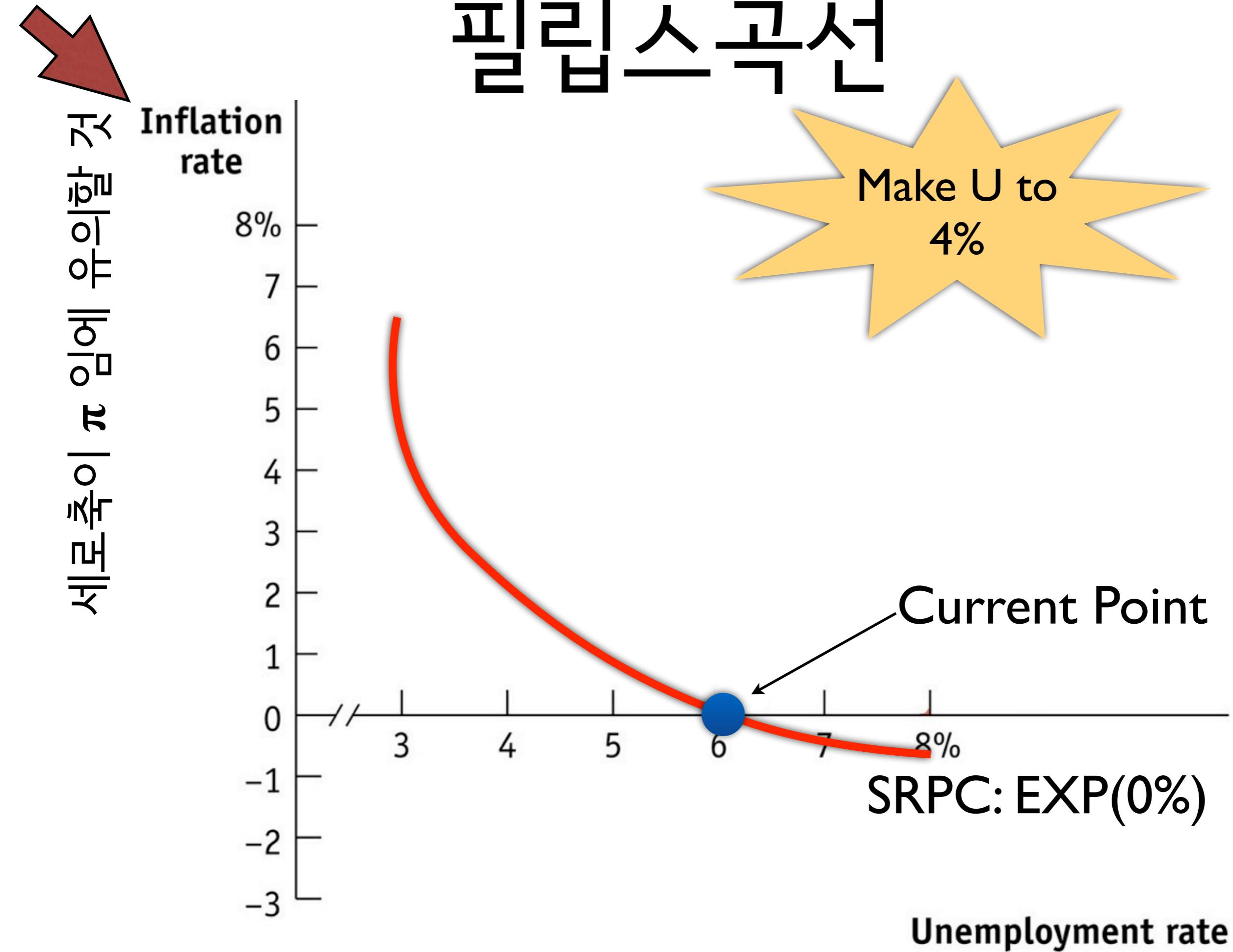
SRPC: EXP(0%)

Unemployment rate

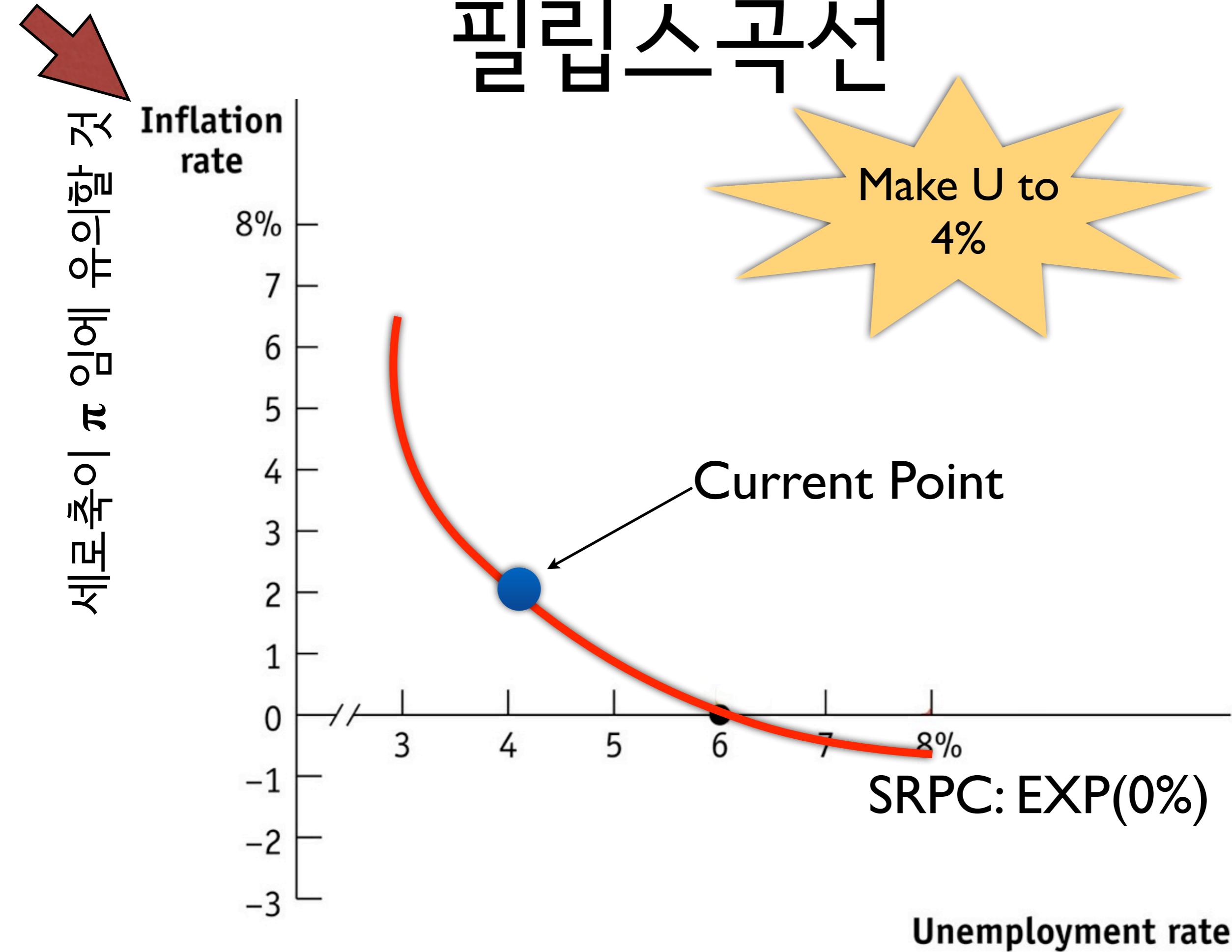
# 풀립스곡선



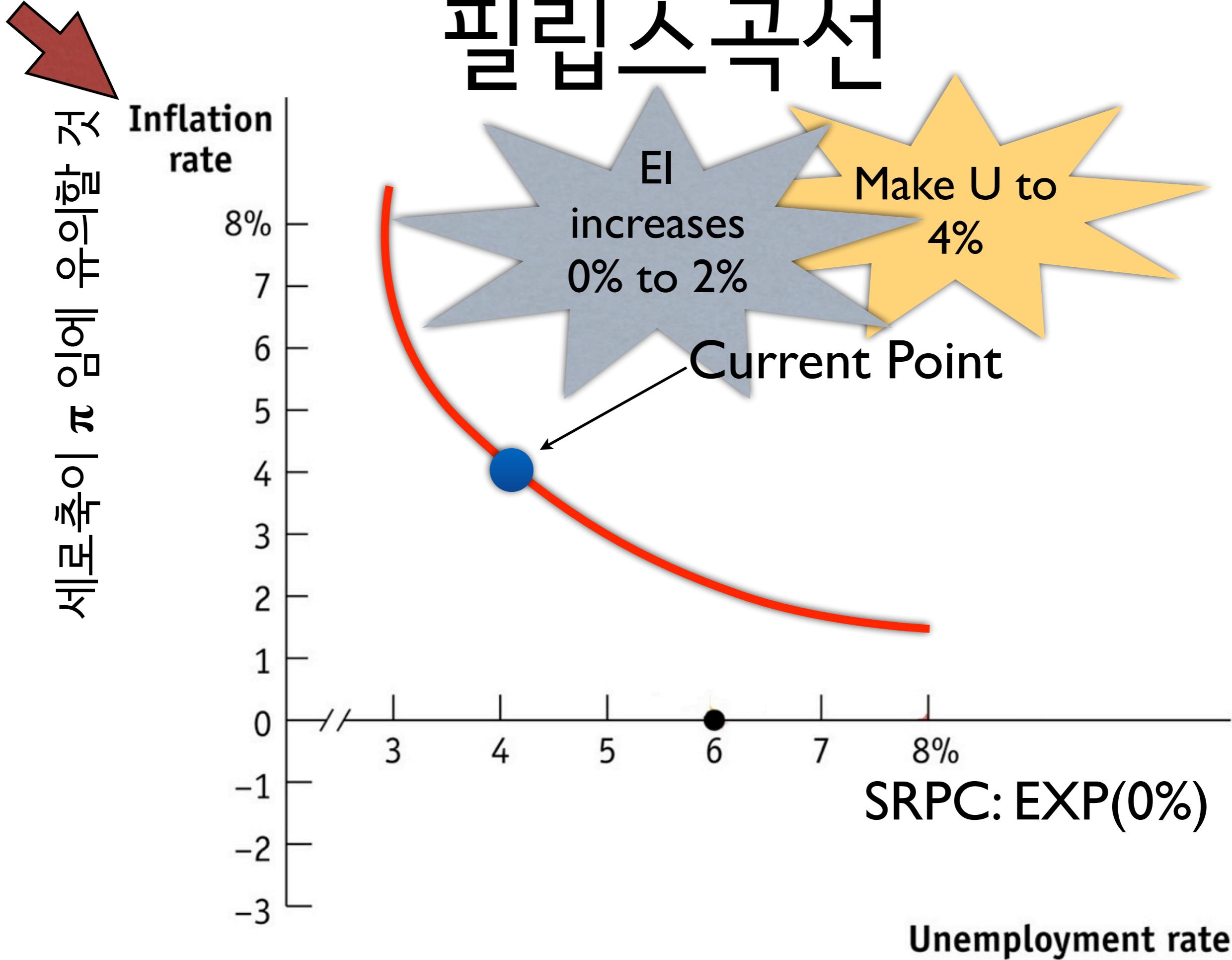
# 풀립스곡선



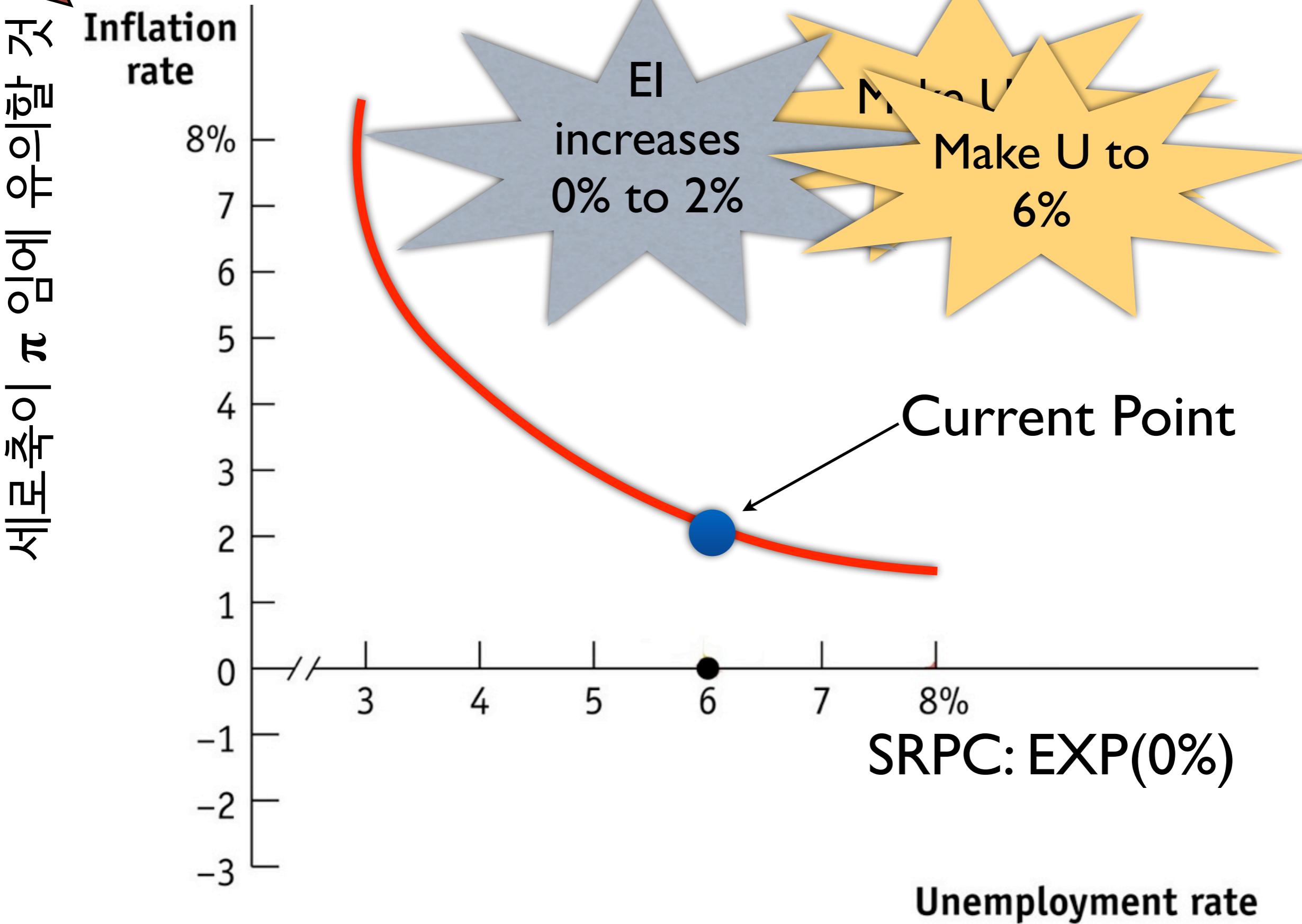
# 풀립스곡선



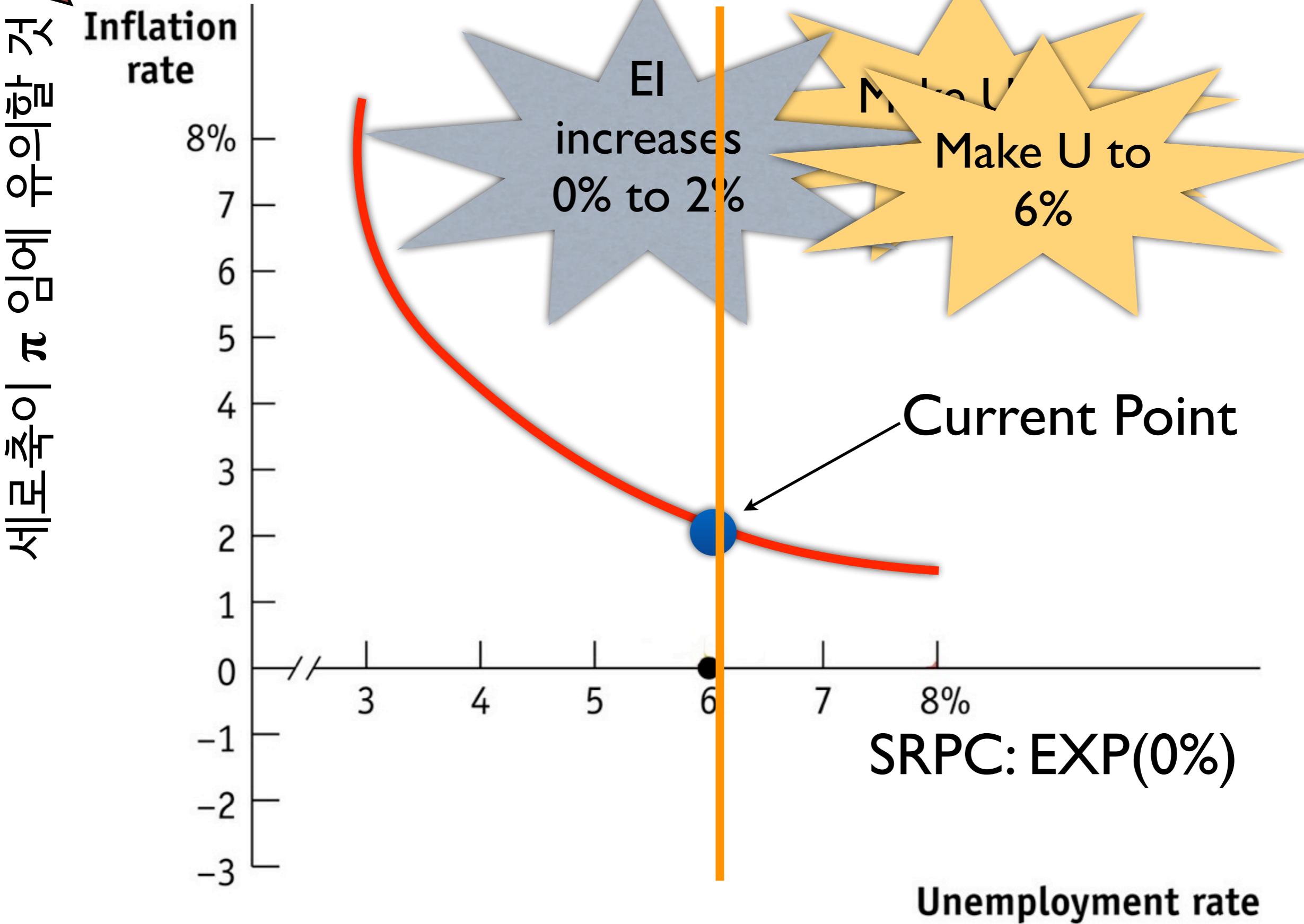
# 풀립스곡선



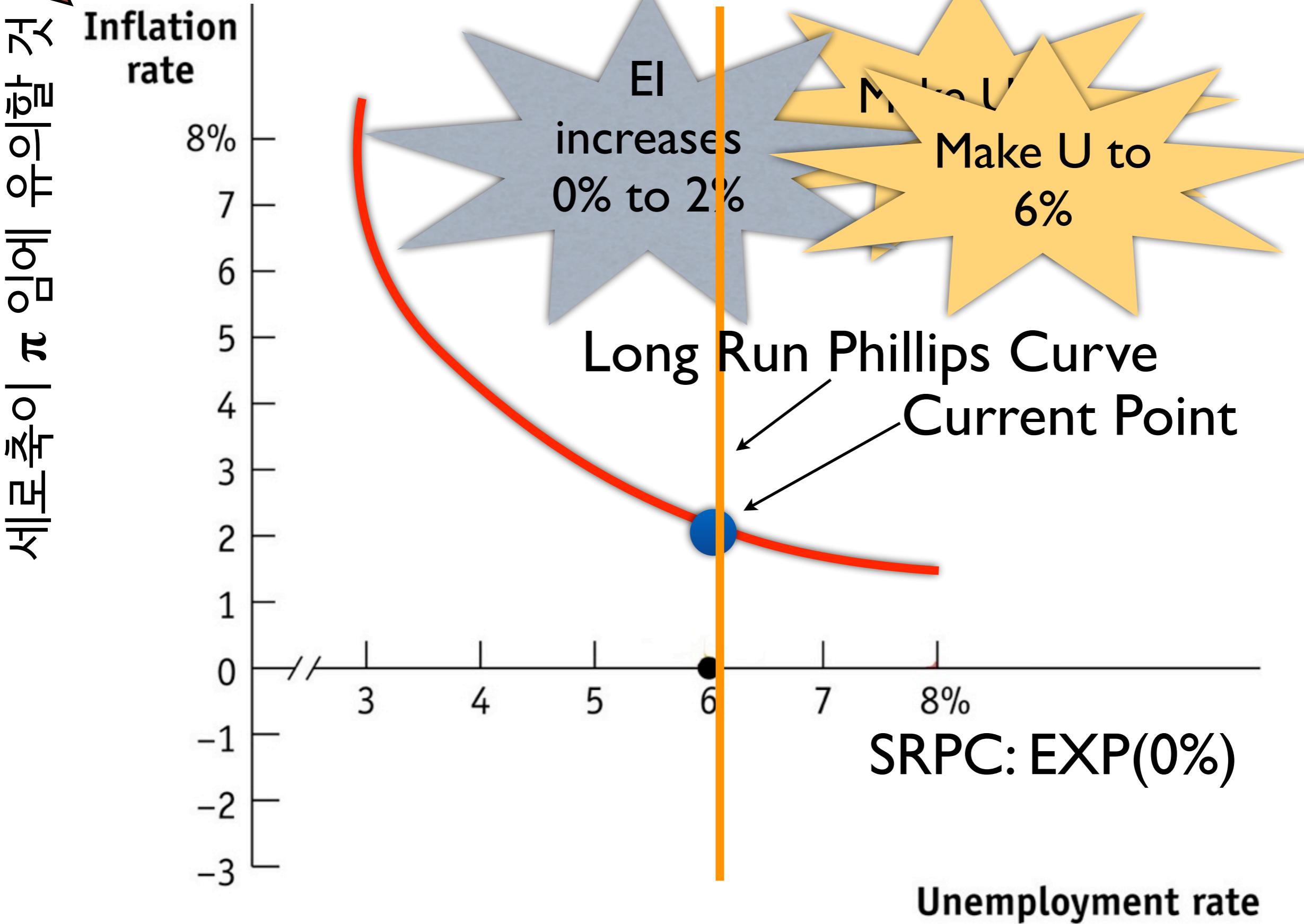
# 필립스 고선



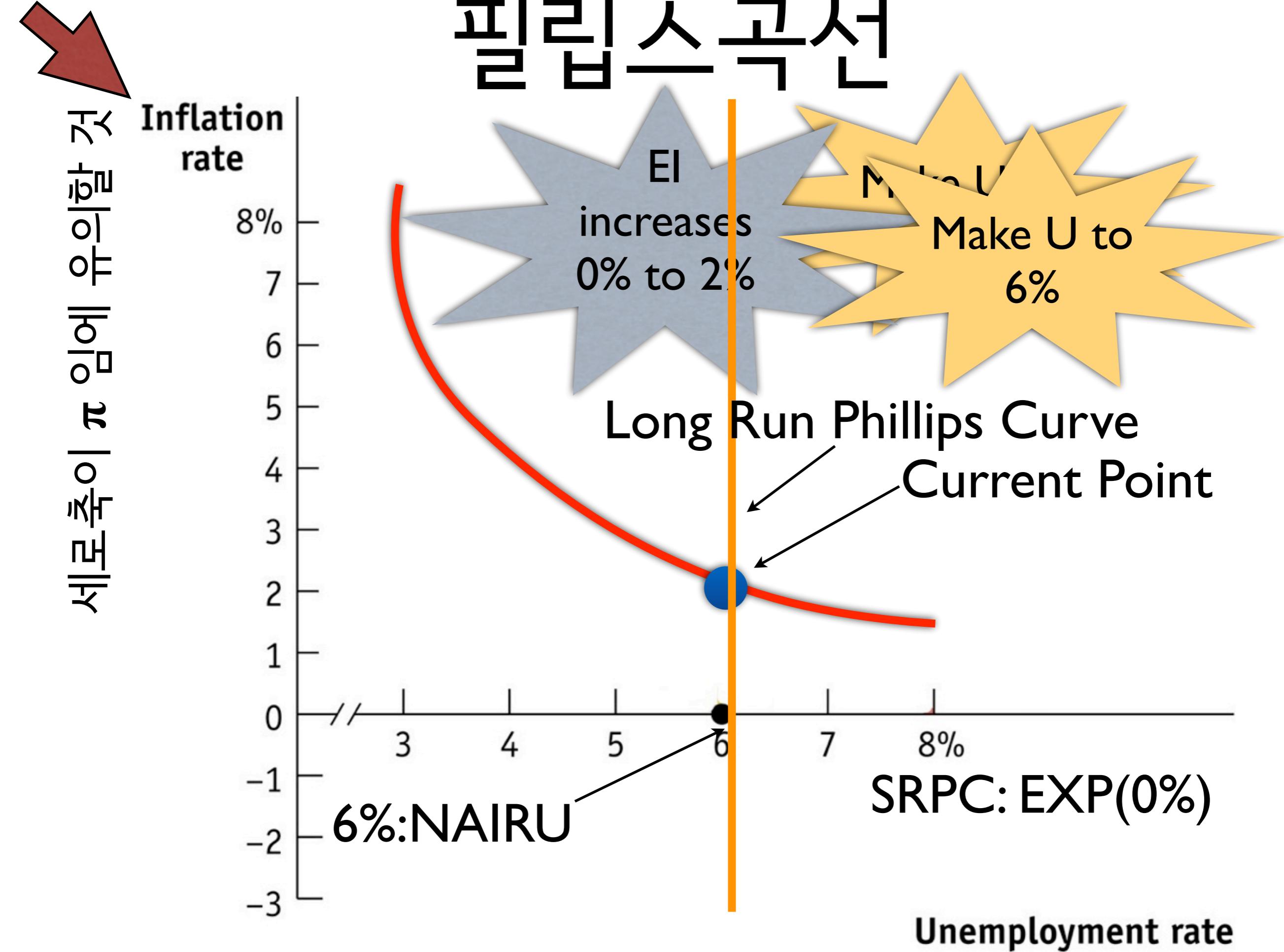
# 필립스 고선



# 필립스 고선



# 필립스 곡선

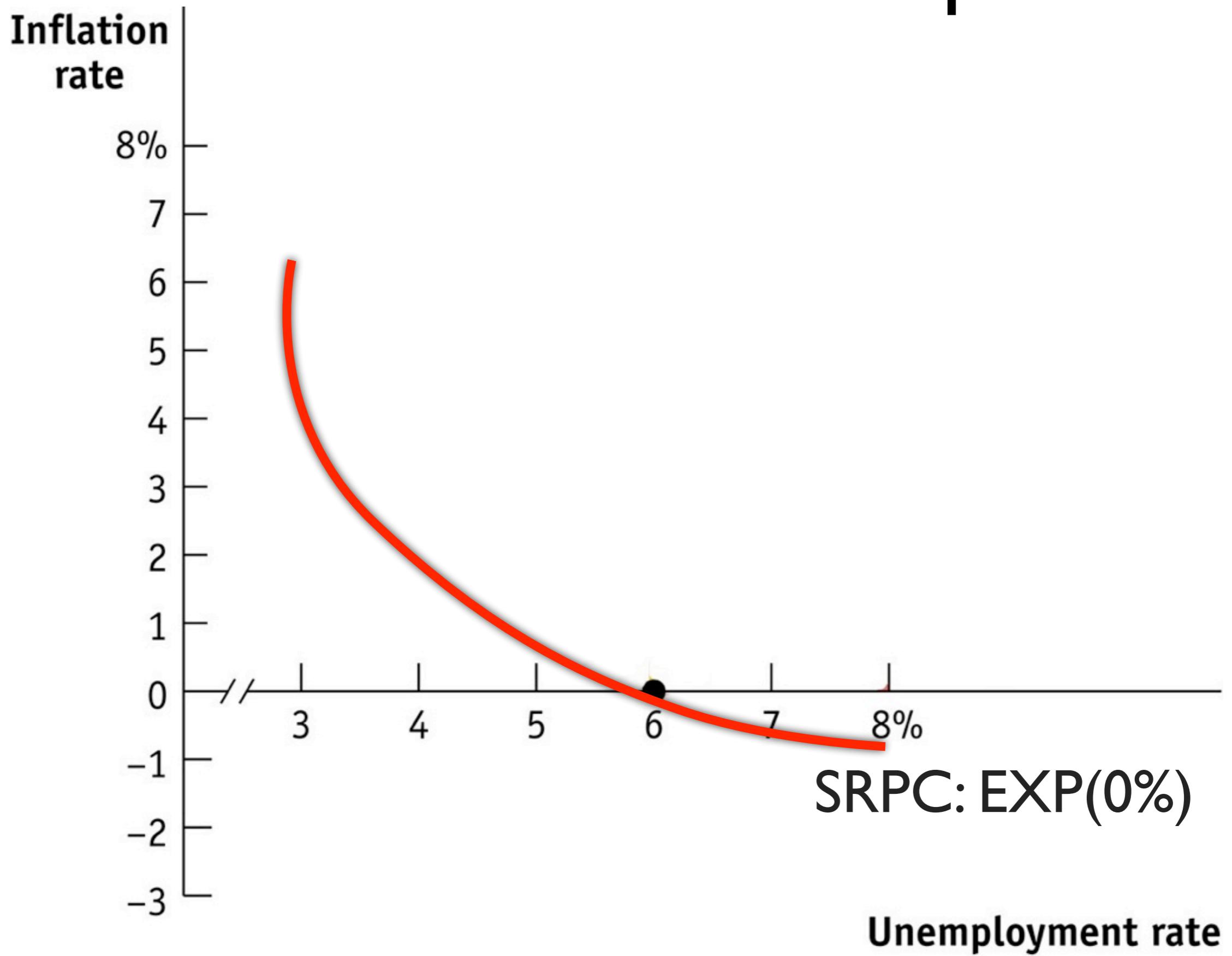


# Disinflation

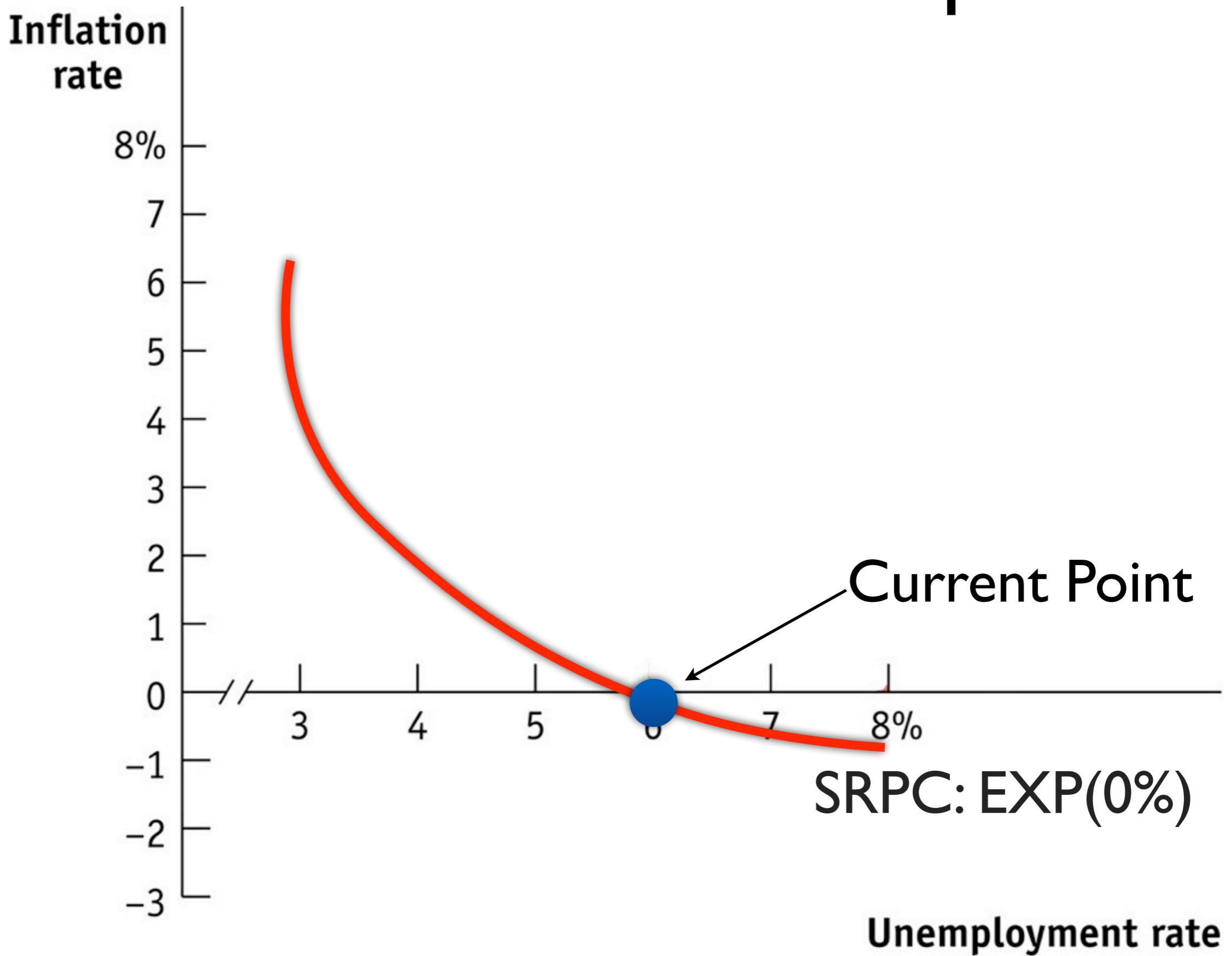
- 기대인플레이션률이 지나치게 높은 수준에 있는 경우 중앙은행은 이를 낮추려 할 수 있음: Disinflation
- 기대를 낮추기 위해서는 실제 기대인플레이션이 낮아질 때까지 Output gap  $< 0$  을 유지해야 함 : 인위적인 불경기를 의미
  - $Y < Y_n$  이 되는 긴축적 통화정책, 혹은
  - $u > u_n$  이 되는 긴축적 통화정책
- 중앙은행의 신뢰가 강한 경우 이 불경기의 기간과 강도는 약해질 수도 있음.
  - 시중의 기대 조정이 빠르게 이뤄질 것이기 때문

# Disinflation: Graph

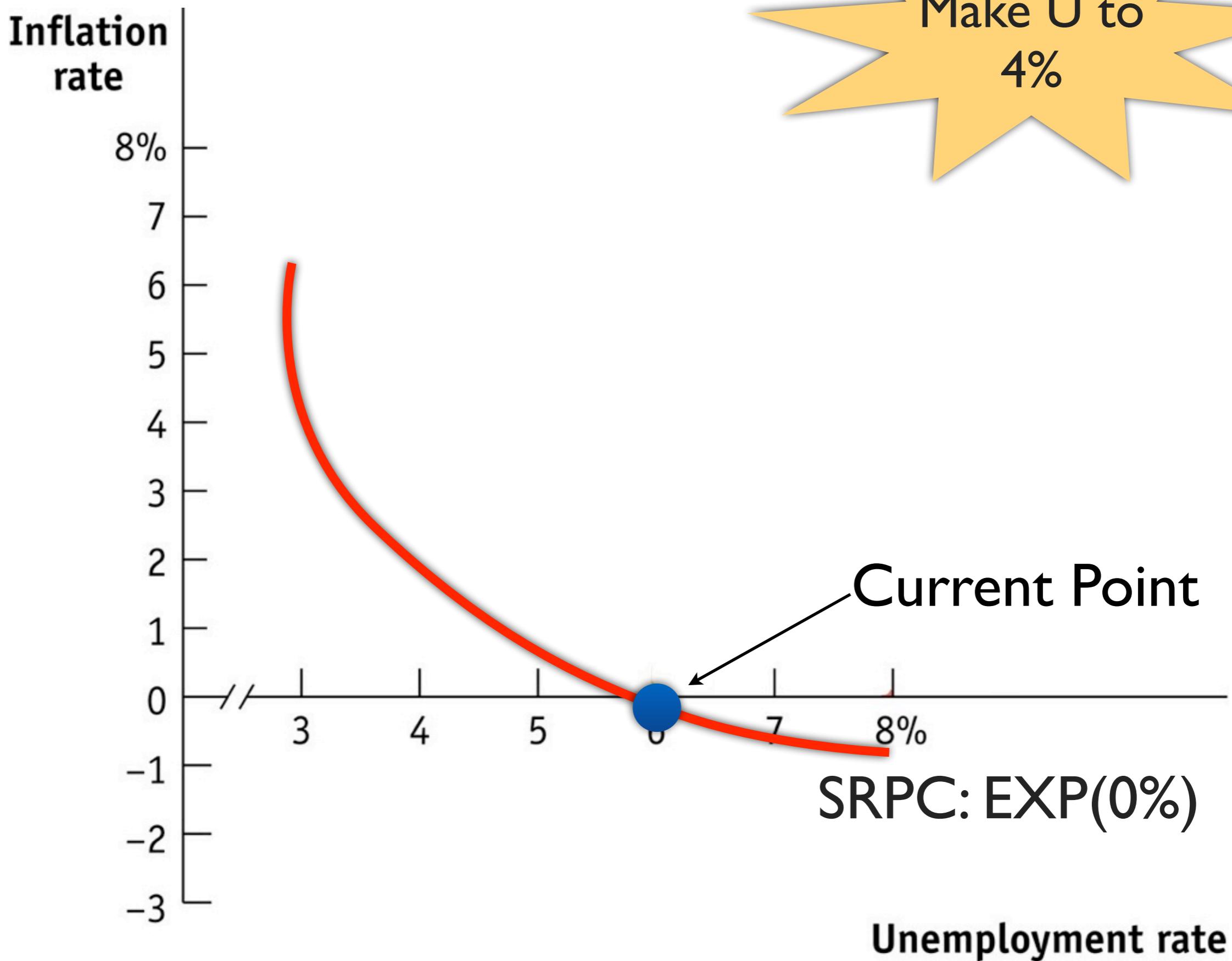
# Disinflation: Graph



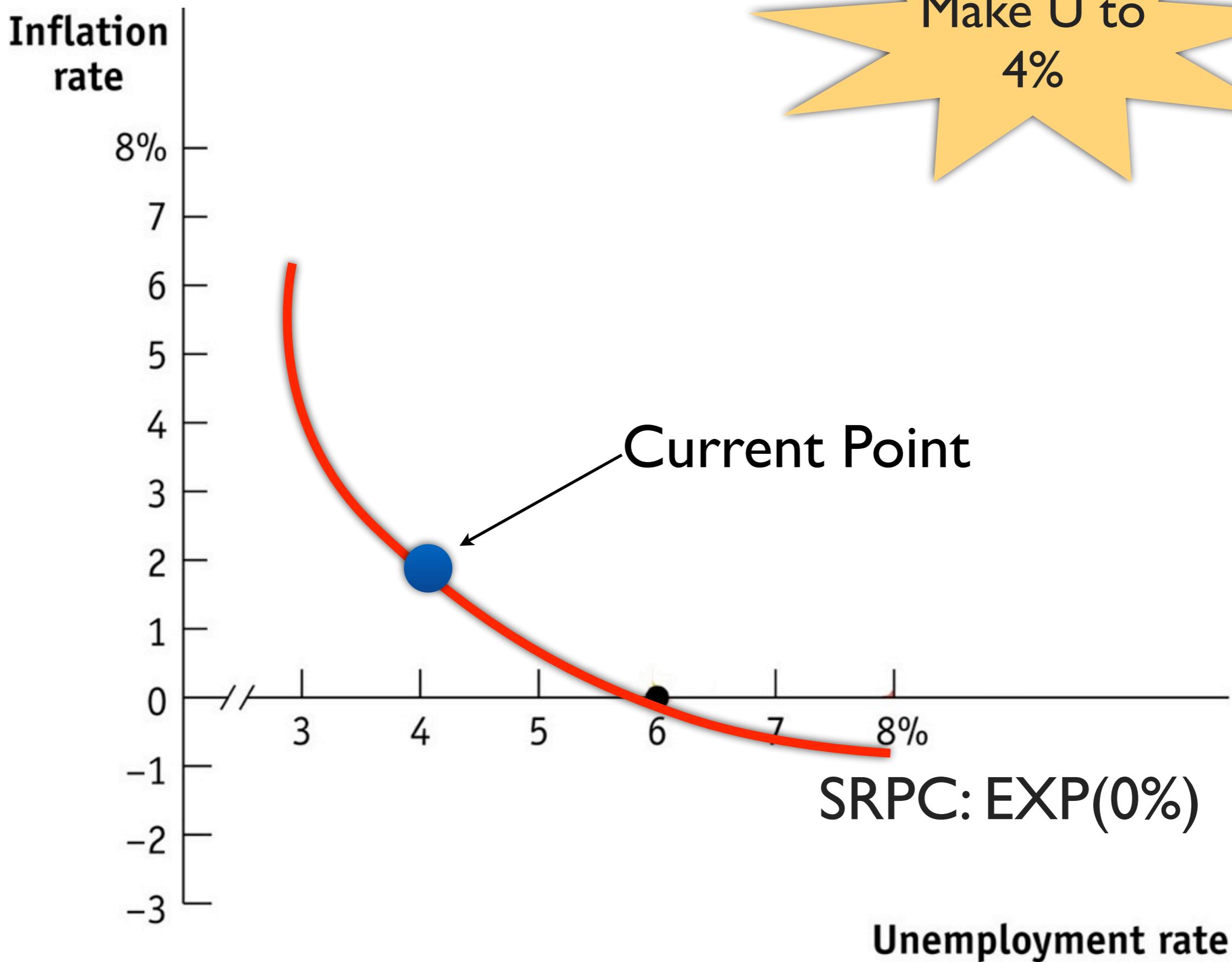
# Disinflation: Graph

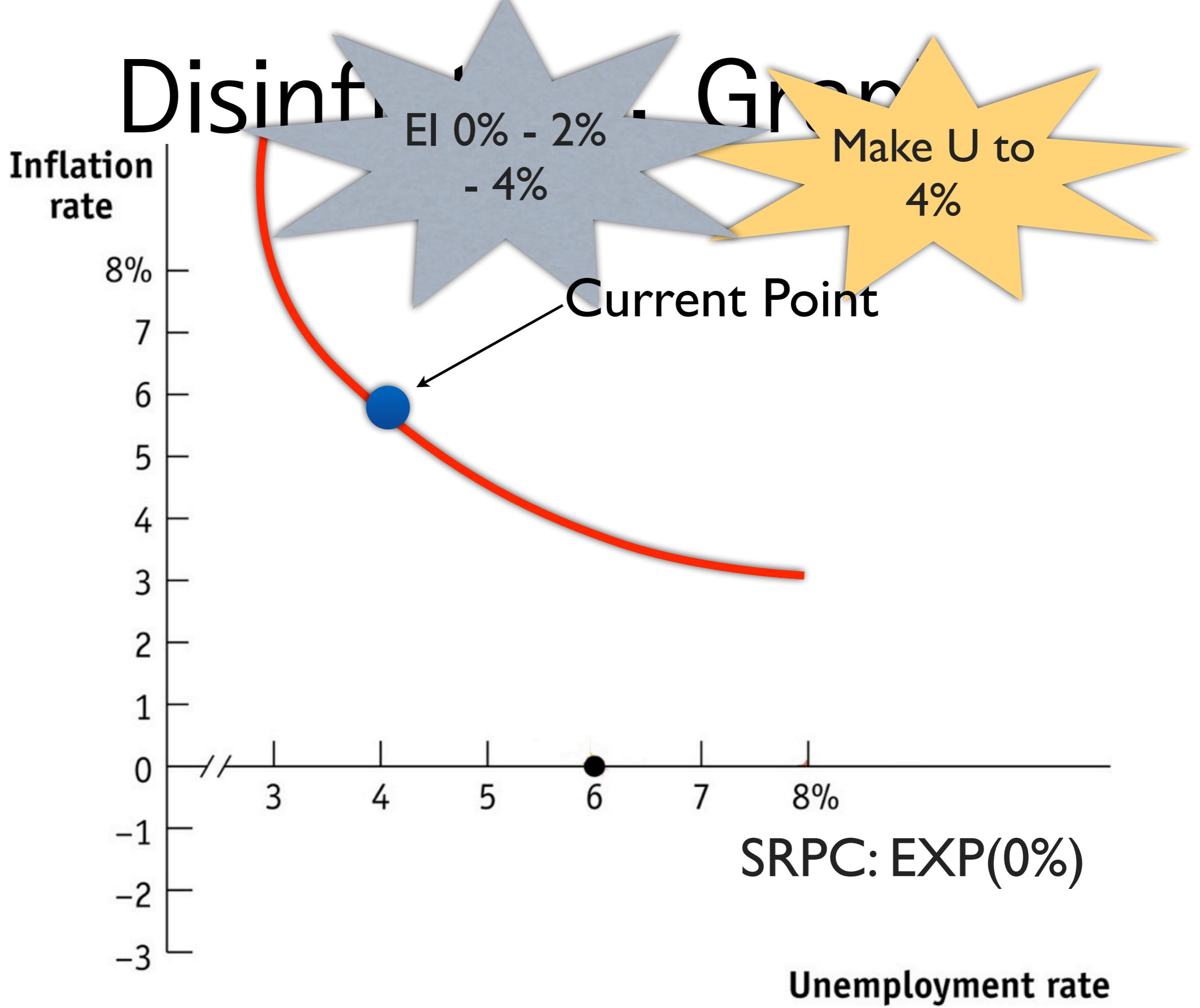


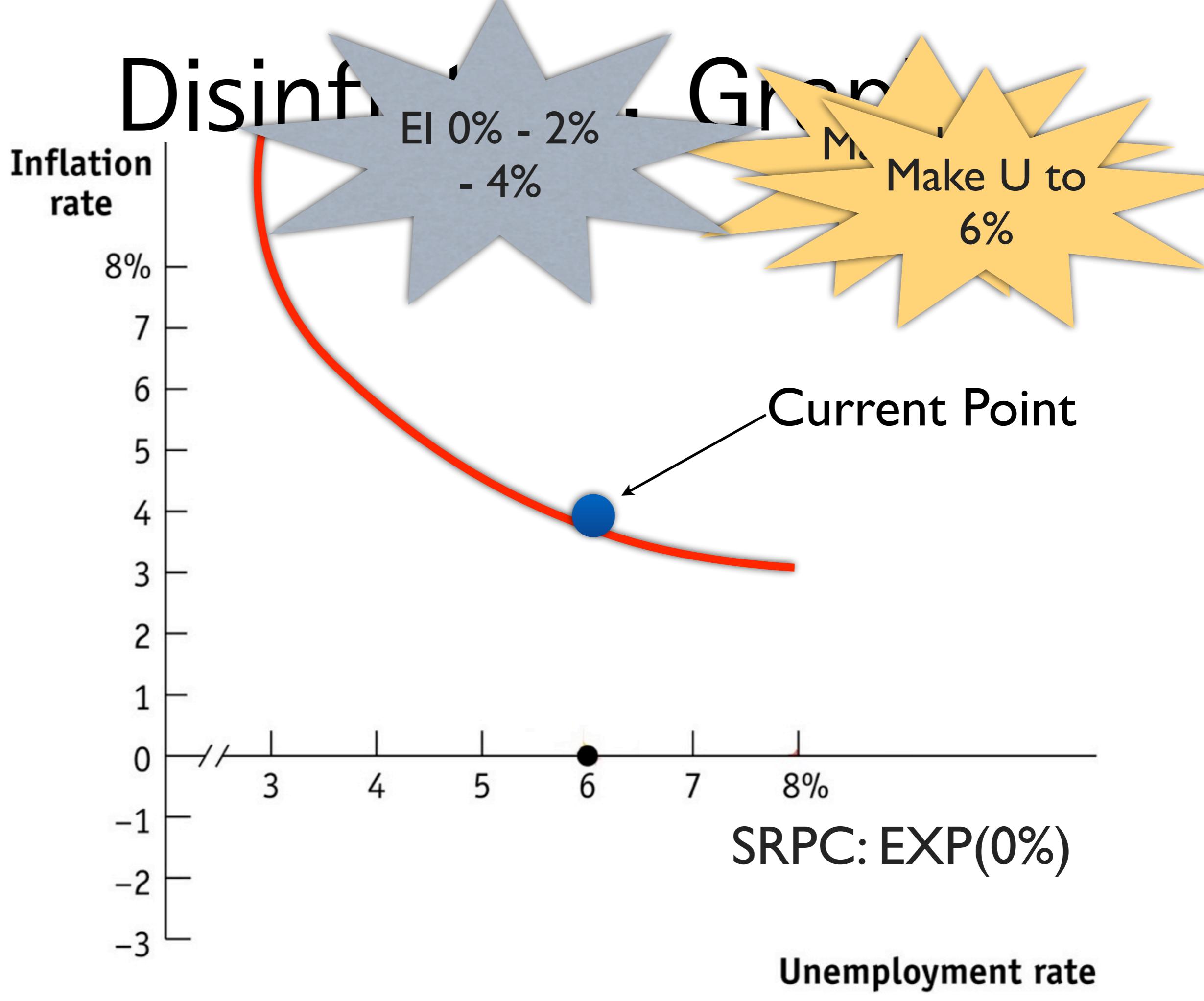
# Disinflation: Grap

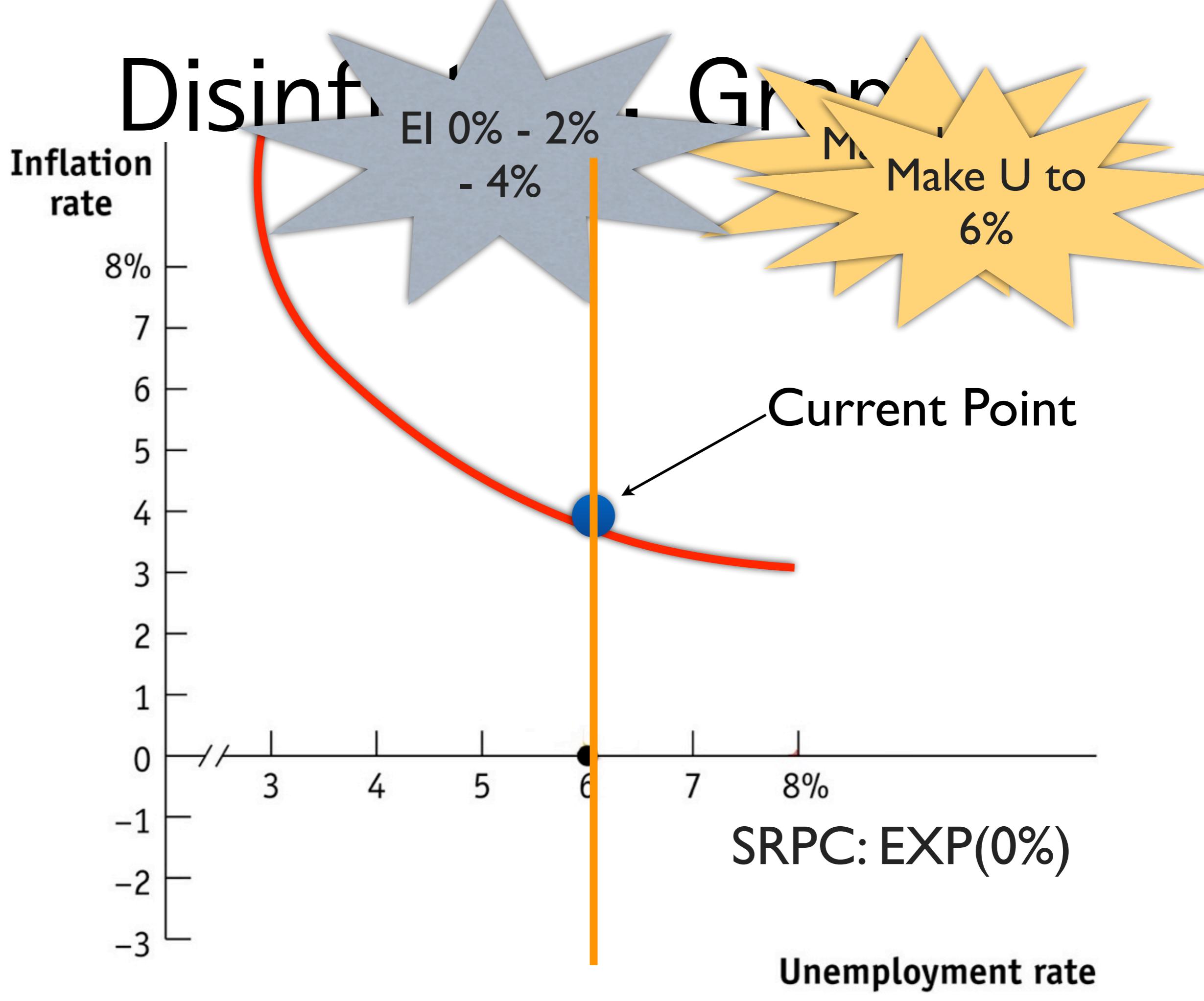


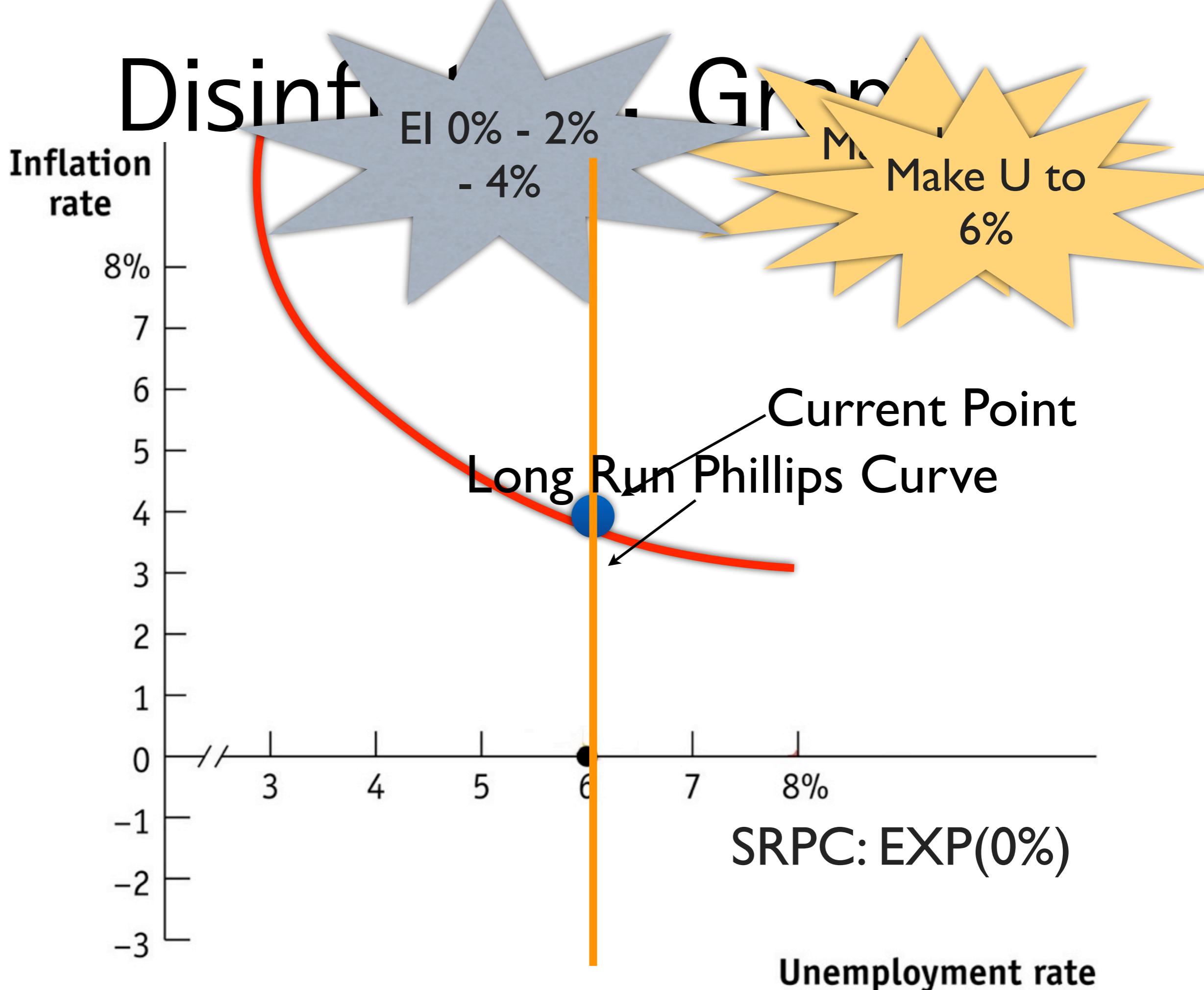
# Disinflation: Grap

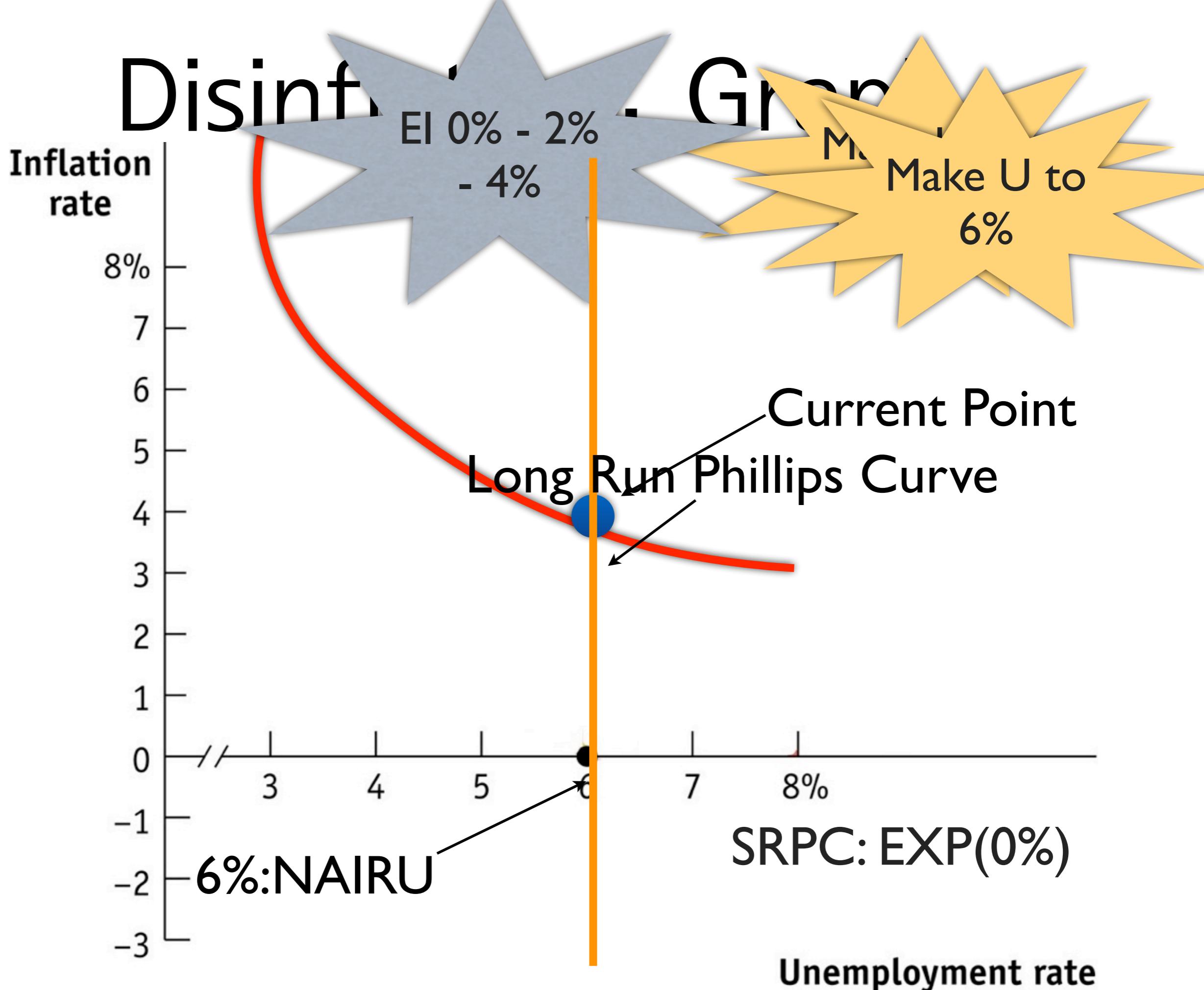


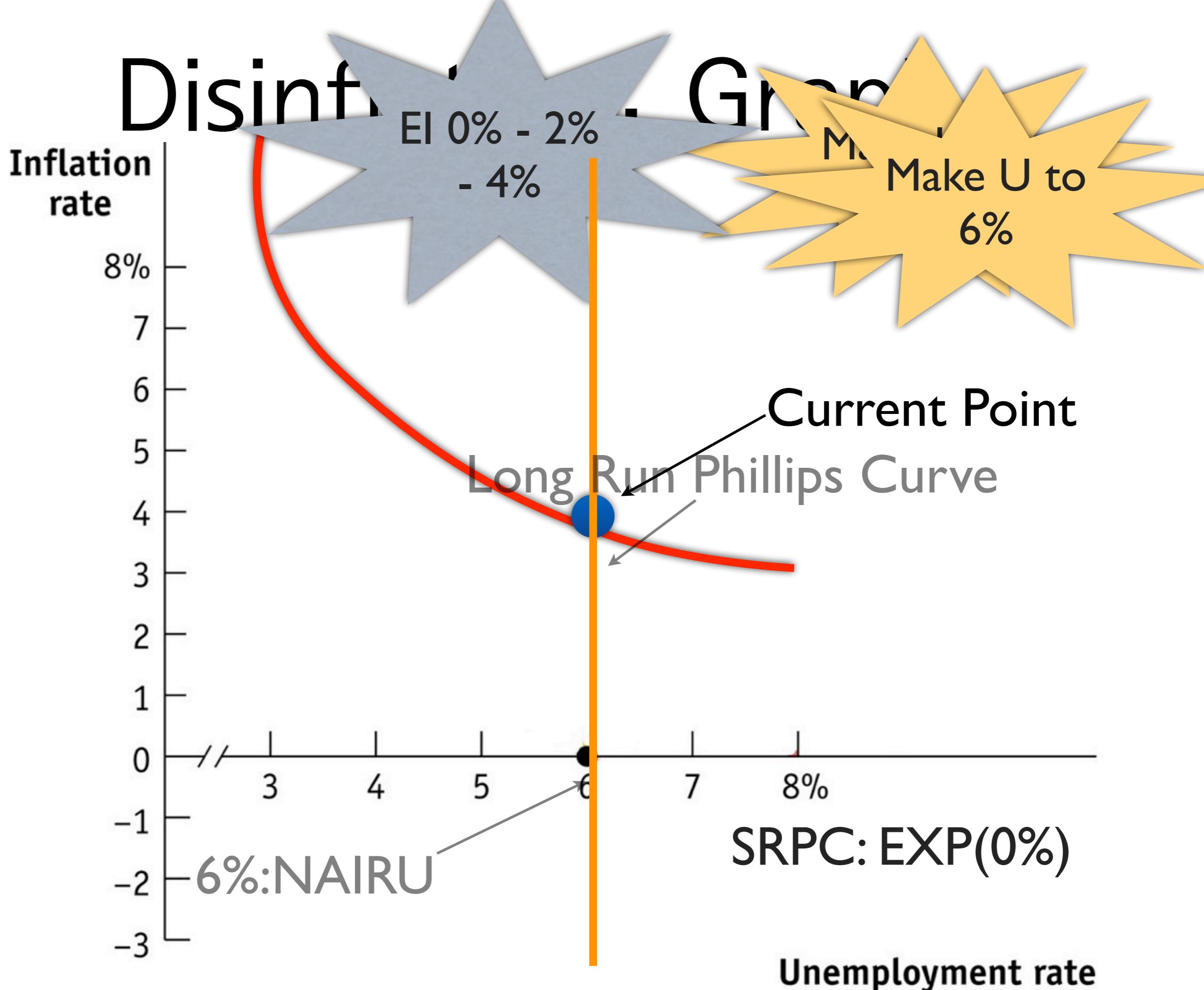


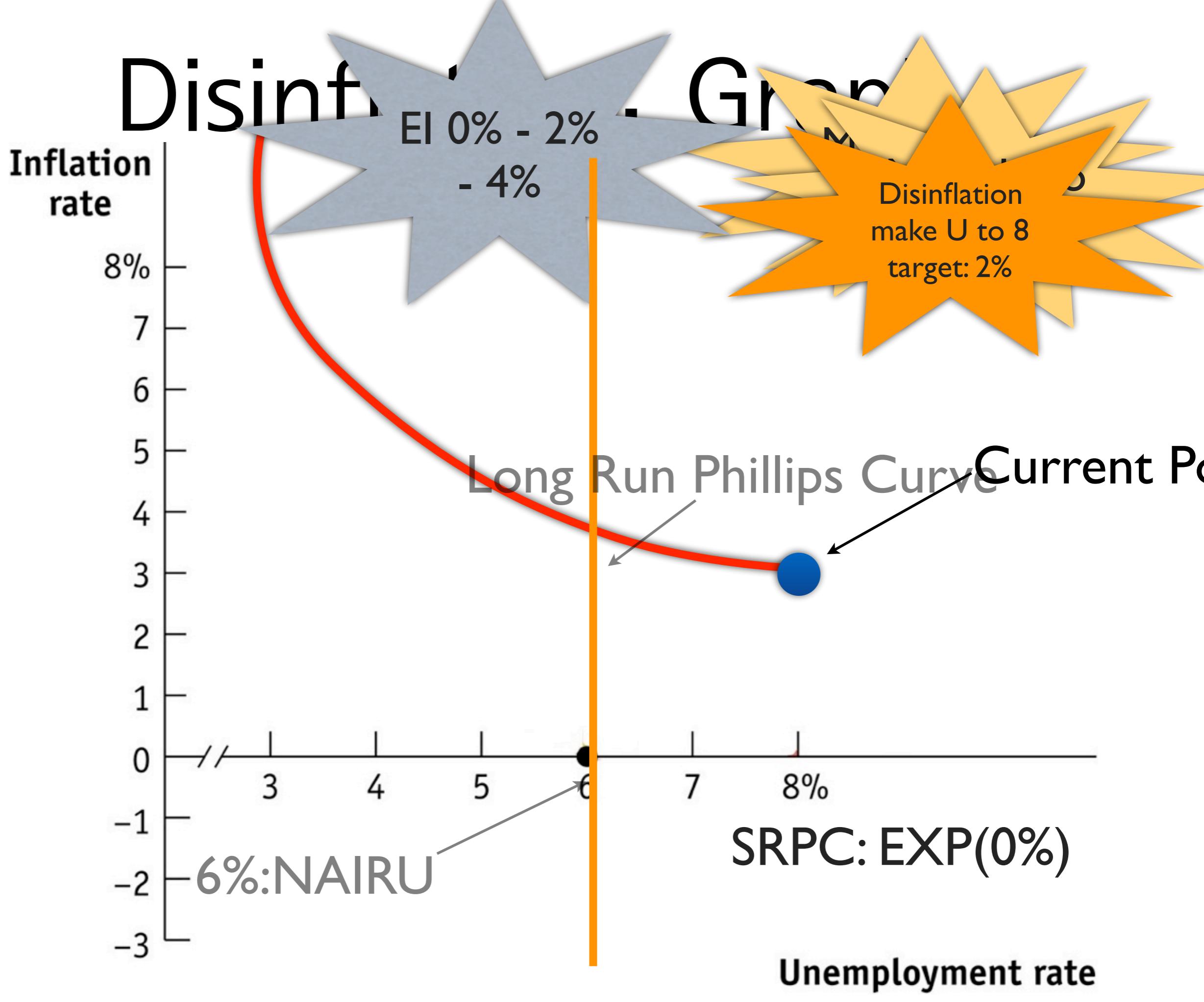


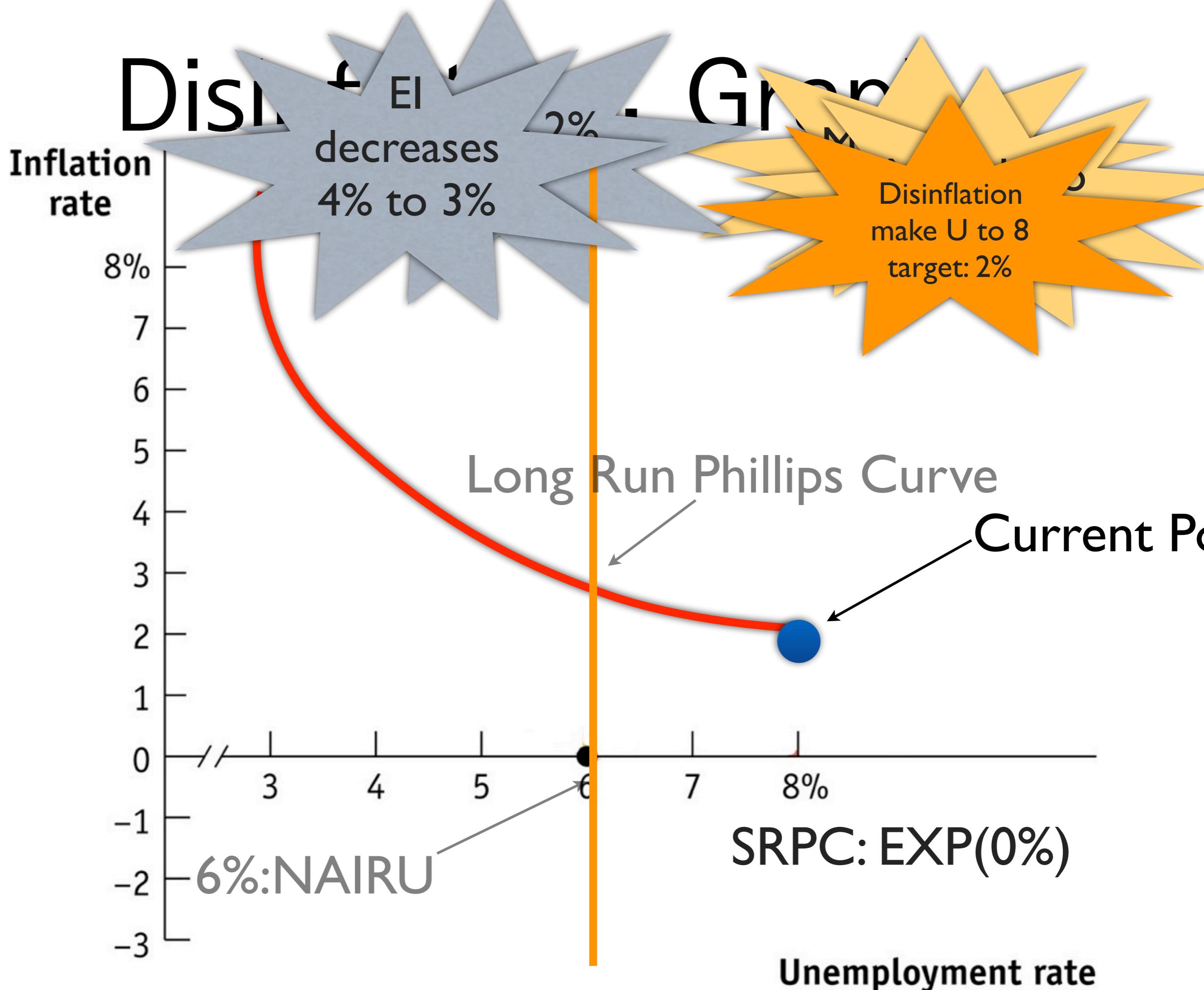


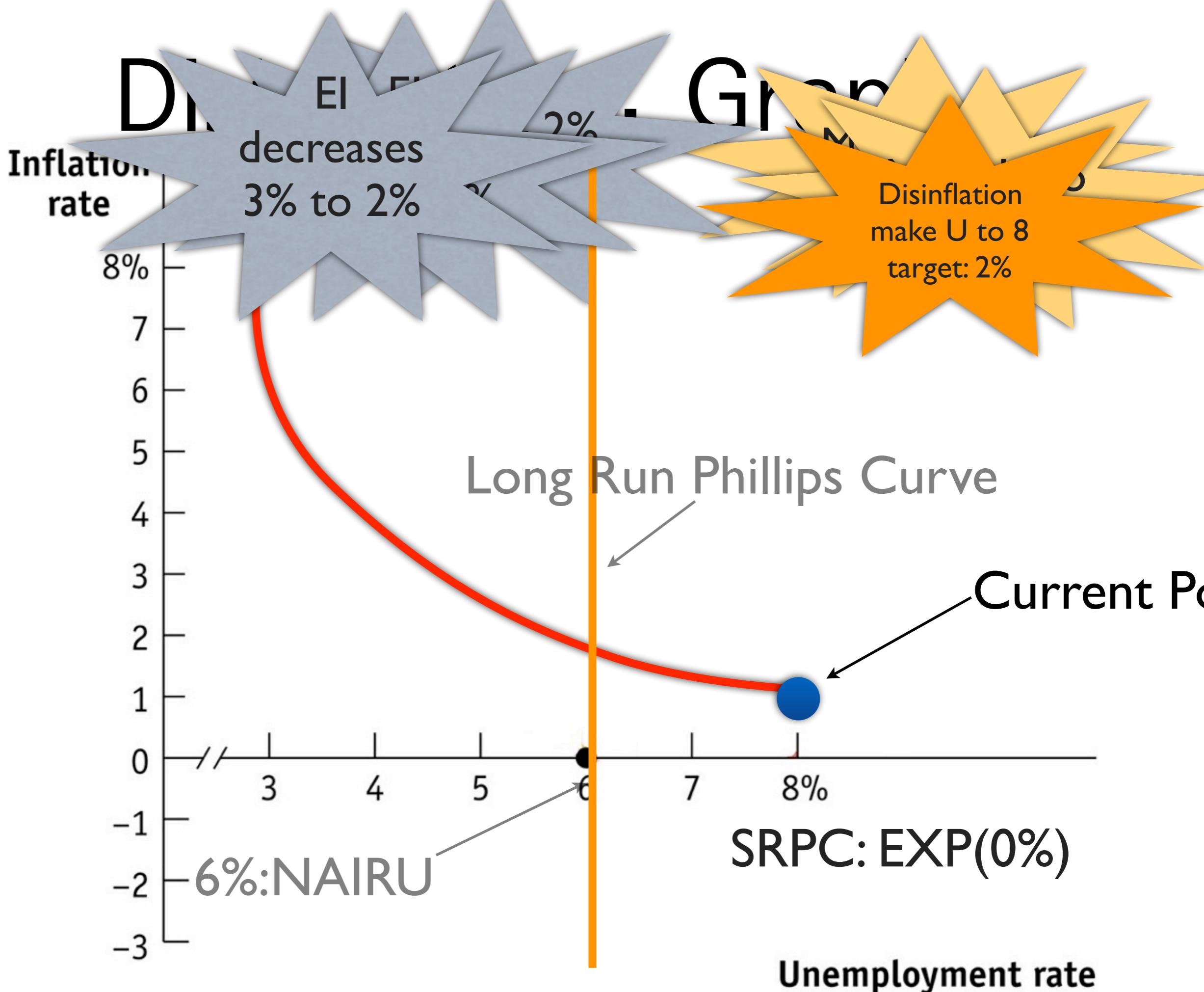


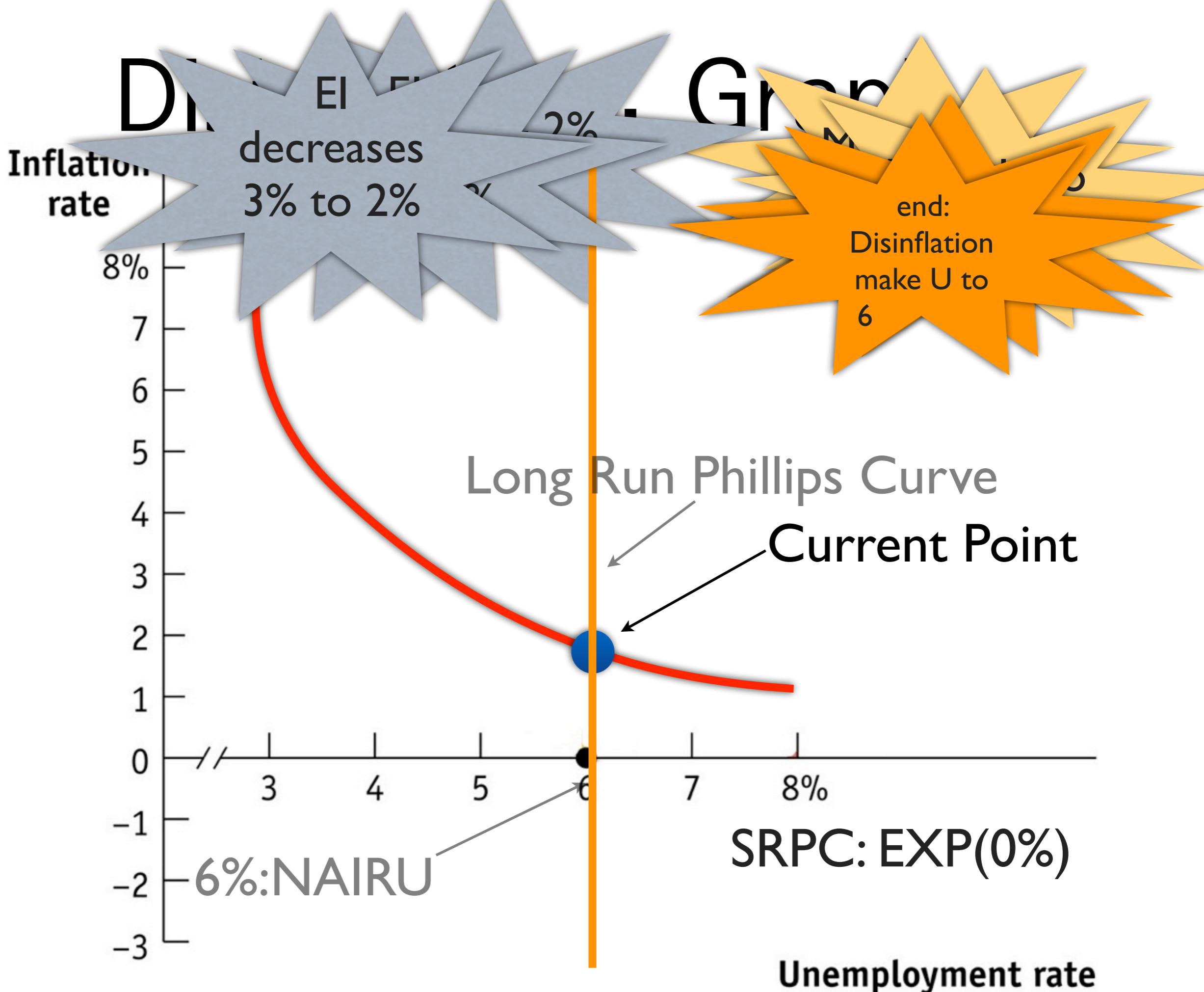






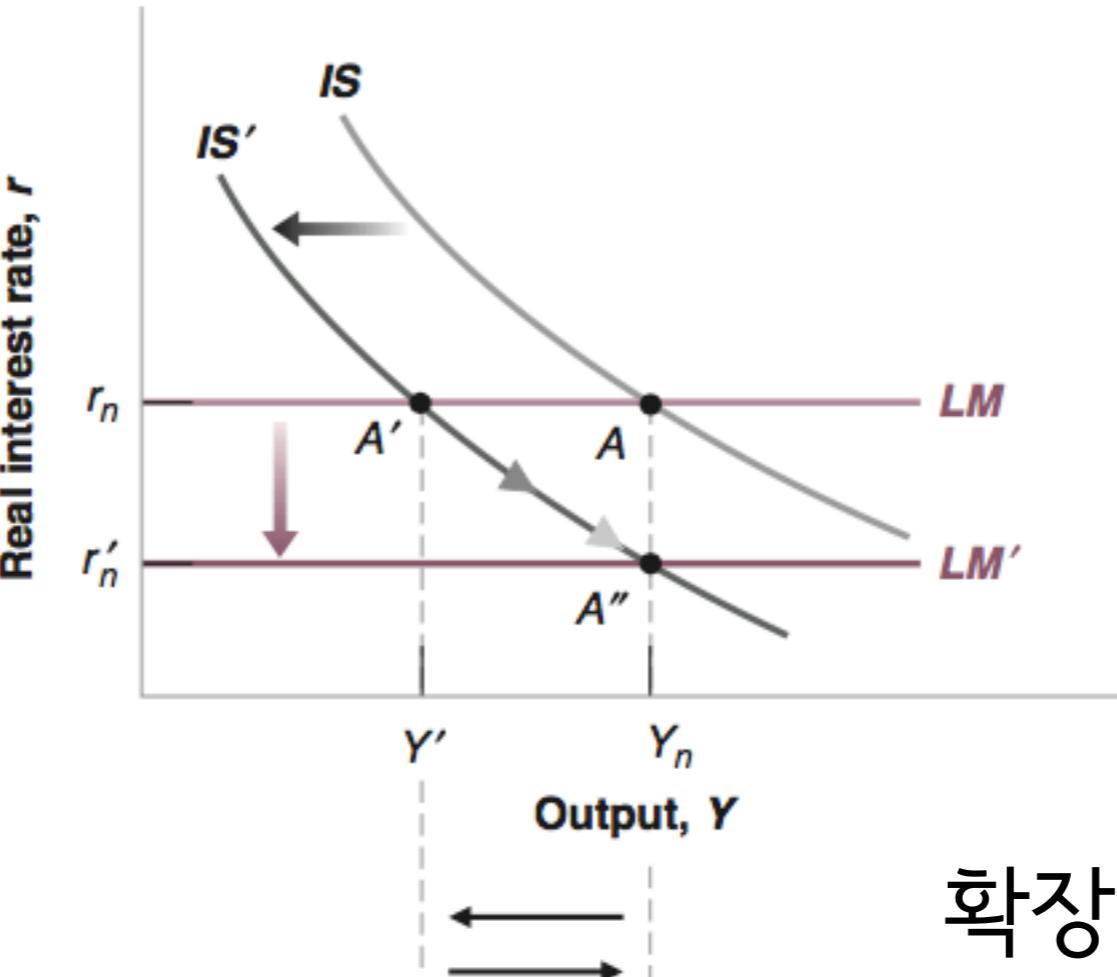




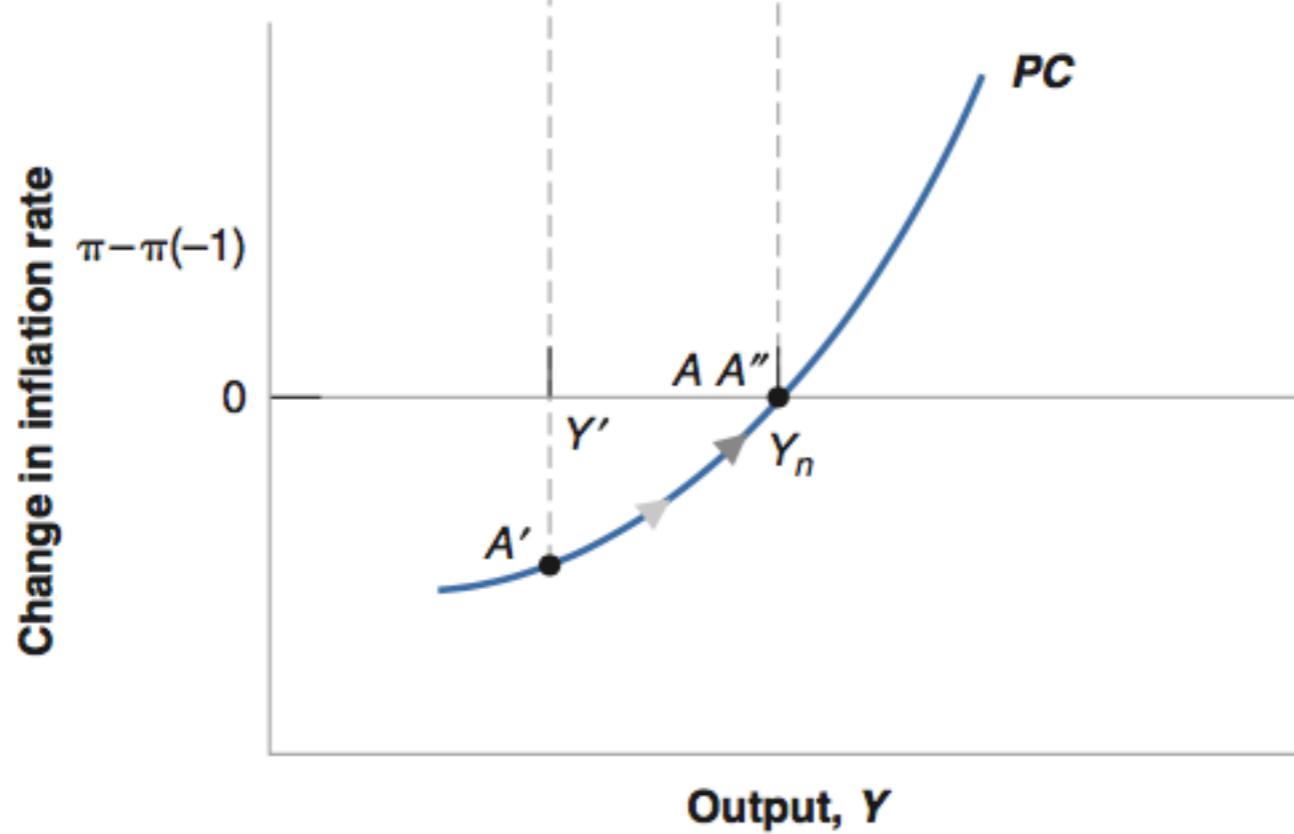


# 정부부채 감축

- 적자재정 규모가 지나치게 높을 경우 긴축 재정 정책을 통해 적자 규모를 감축해야 할 경우가 있음
  - $\Delta T > 0$  (증세), or  $\Delta G < 0$  (지출감소)
  - 긴축 재정 정책으로 인한 불경기 발생 우려 존재
  - 거시적 효과는 disinflation과 유사
- 단기효과는 불경기이지만 중장기적으로는 성장에 더 큰 기여를 하게 됨.
  - 관건은 조정 시간 (짧을 수록 good)



긴축재정과  
확장적 통화정책의 Mix

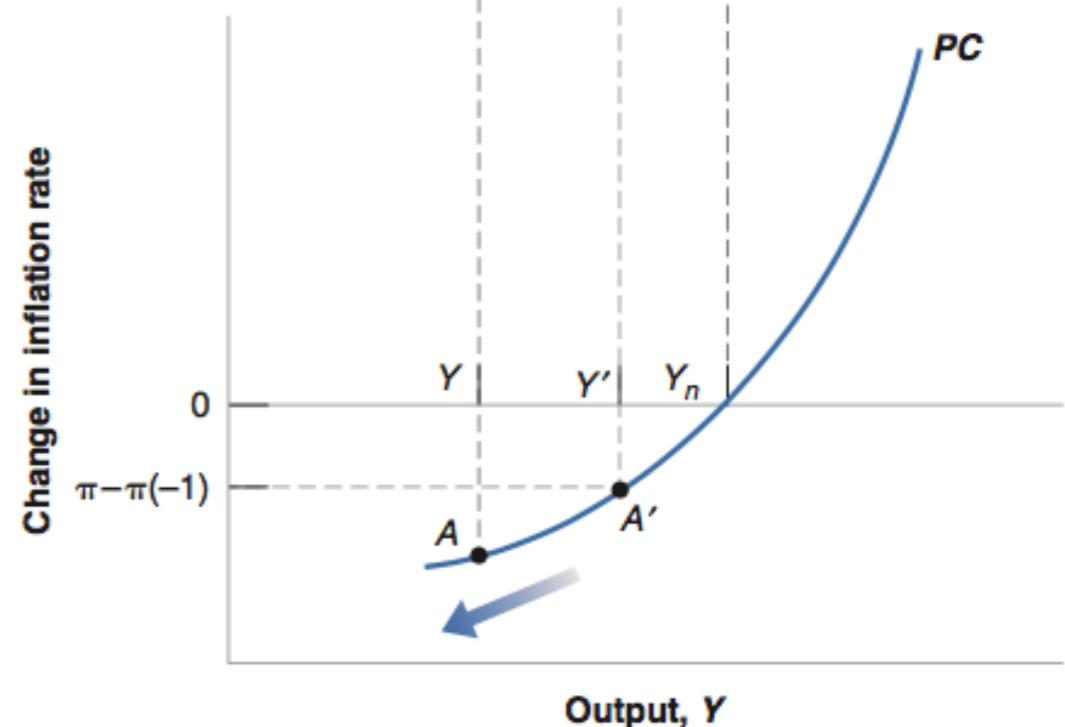
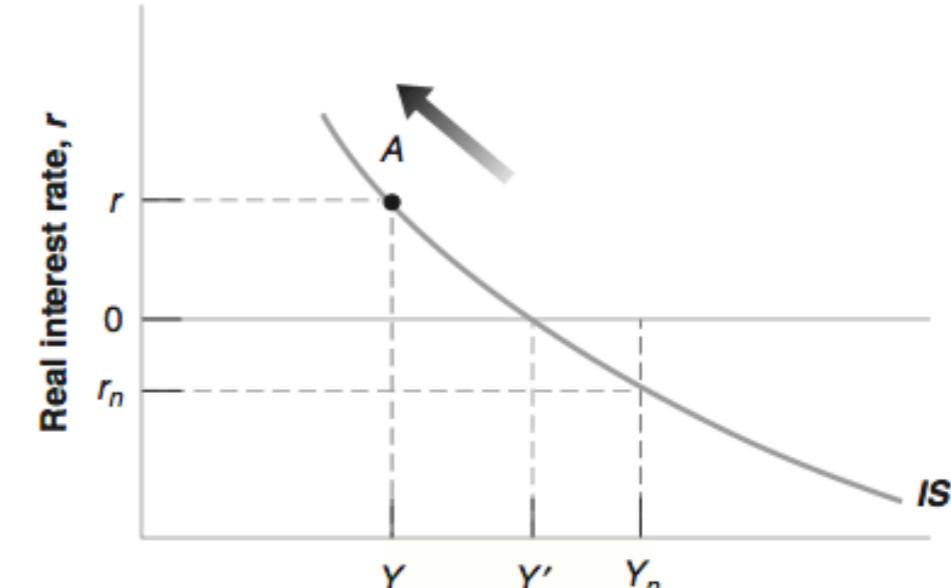


# 불경기의 동학

- Blanchard가 IS-LM-PC 모형을 도입한 이유
- AS-AD, 혹은 기존의 모형들은 zero lower bound 와 deflation 시기의 비대칭 행태를 포착하지 못함
  - $Y < Y_n$  (혹은  $u > u_n$ ) 이 지속될 경우 물가가 하락한다는 점을 기억해두도록 하자.
  - 편의상 현재의 inflation rate = 0 이라고 생각하자
    - $r = i + 0 = i \geq 0$

# 디플레이션 함정

- 심각한 불경기에서 자연이자율이 0보다 작을 경우 중앙은행은 zero lower bound로 인해  $Y' < Y_n$  이 되는 이자율 0만을 달성할 수 있음
- $Y' < Y_n$  이므로 물가가 하락  $\Rightarrow \pi^e$  하락  $\Rightarrow$  지속적인 물가하락
- Deflation spiral, or Deflation trap



# 2008년 위기와 디플레이션

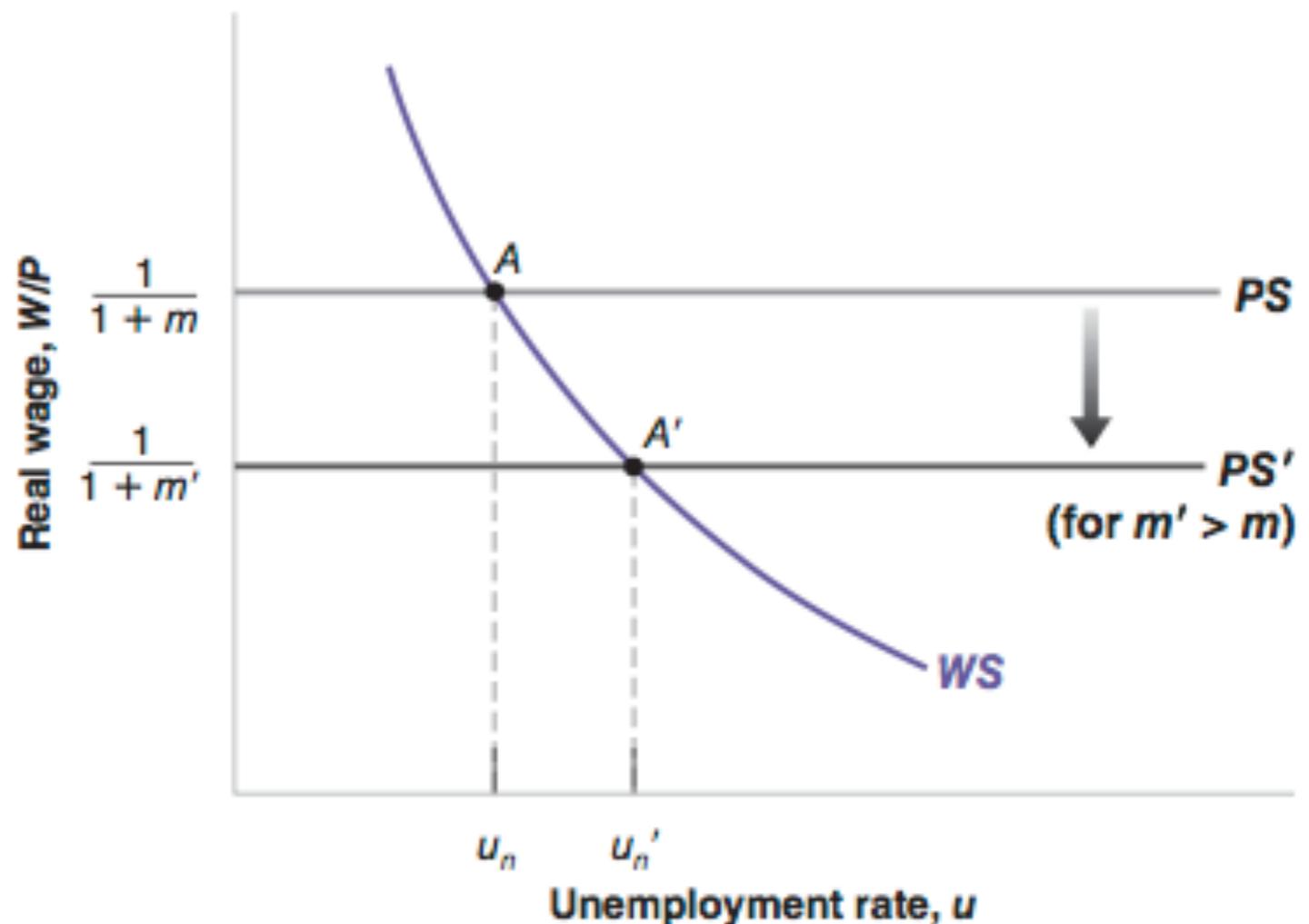
- 디플레이션 함정에는 빠지지 않음
- 주된 원인: 기대인플레이션이 0 근방에서 머물렀기 때문
- 디플레이션 함정은 기대인플레이션의 디플레이션으로의 조정을 수반해야 발생함
- 기대인플레이션이 변동하지 않을 경우 ( $\pi$  를 세로축으로 하는) PC는 이동하지 않음.

장기 유가상승  
⇒ 자연실업률 증가

Figure 7-12

*The Effects of an Increase  
in the Price of Oil on  
the Natural Rate of  
Unemployment*

An increase in the price of oil leads to a lower real wage and a higher natural rate of unemployment.



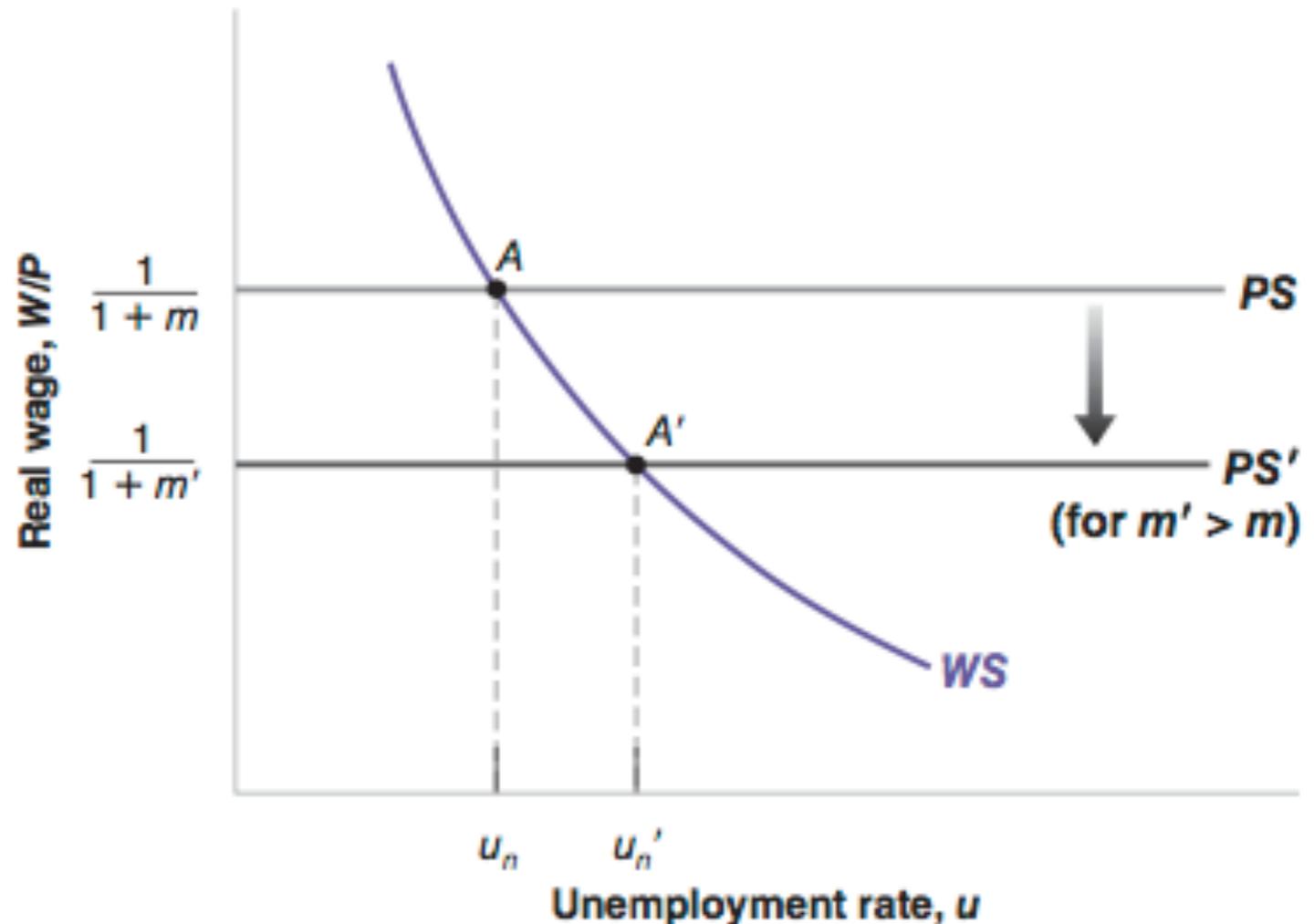
장기 유가상승  
⇒ 자연실업률 증가

주의: 일시적인 경우에는 제한적

Figure 7-12

*The Effects of an Increase  
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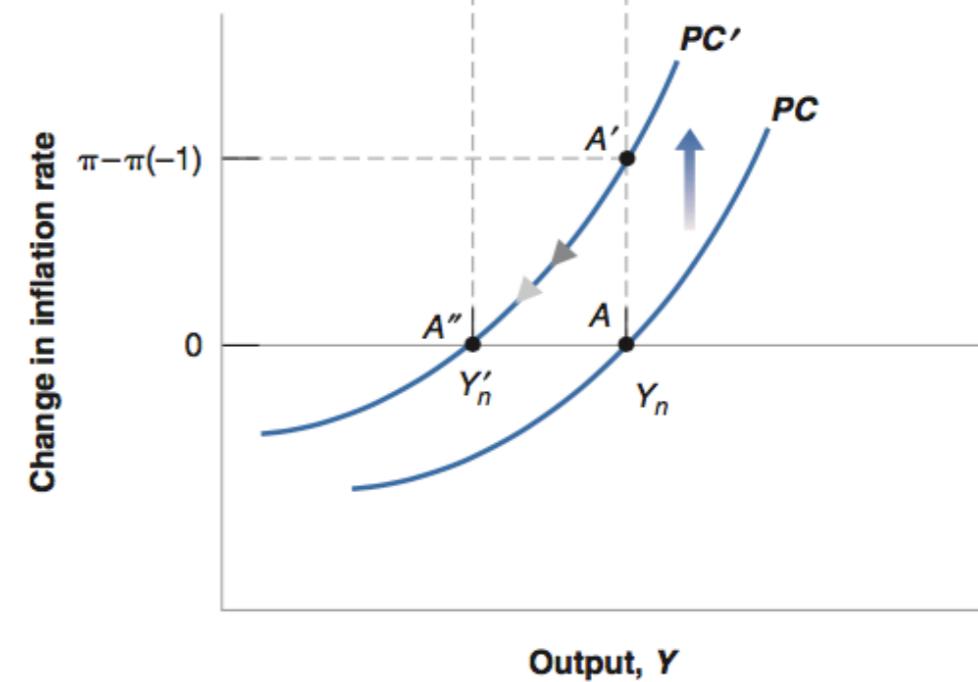
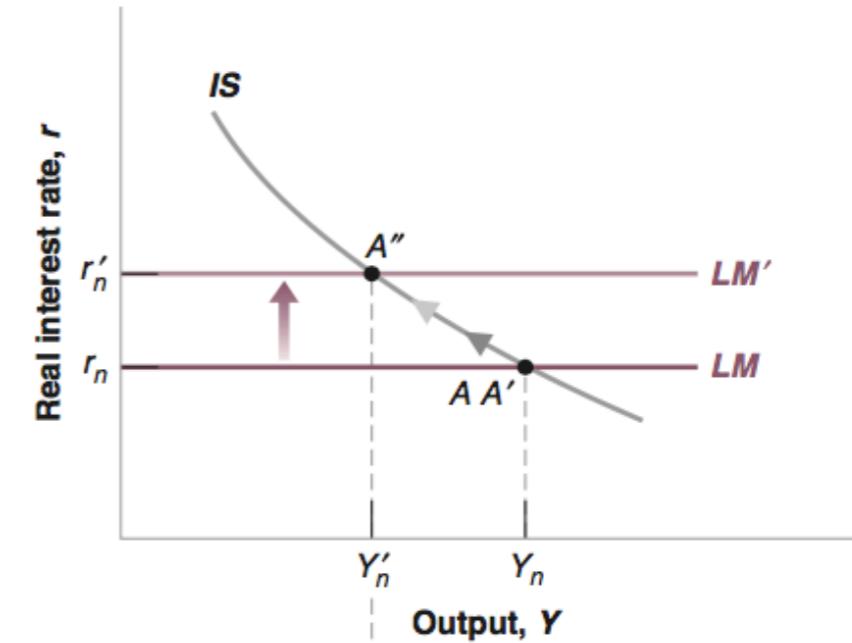


# 장기 유가상승의 효과

- $Y_n$  하락 =  $r_n$  상승: LM 곡선 상승
- ( $\pi - \pi^e$  를 세로축으로 하는) PC 상승
- 경기하강과 물가상승이 동반됨: Stagflation
- 참고: AS-AD 모형에서는 Negative AS shock 으로 설명

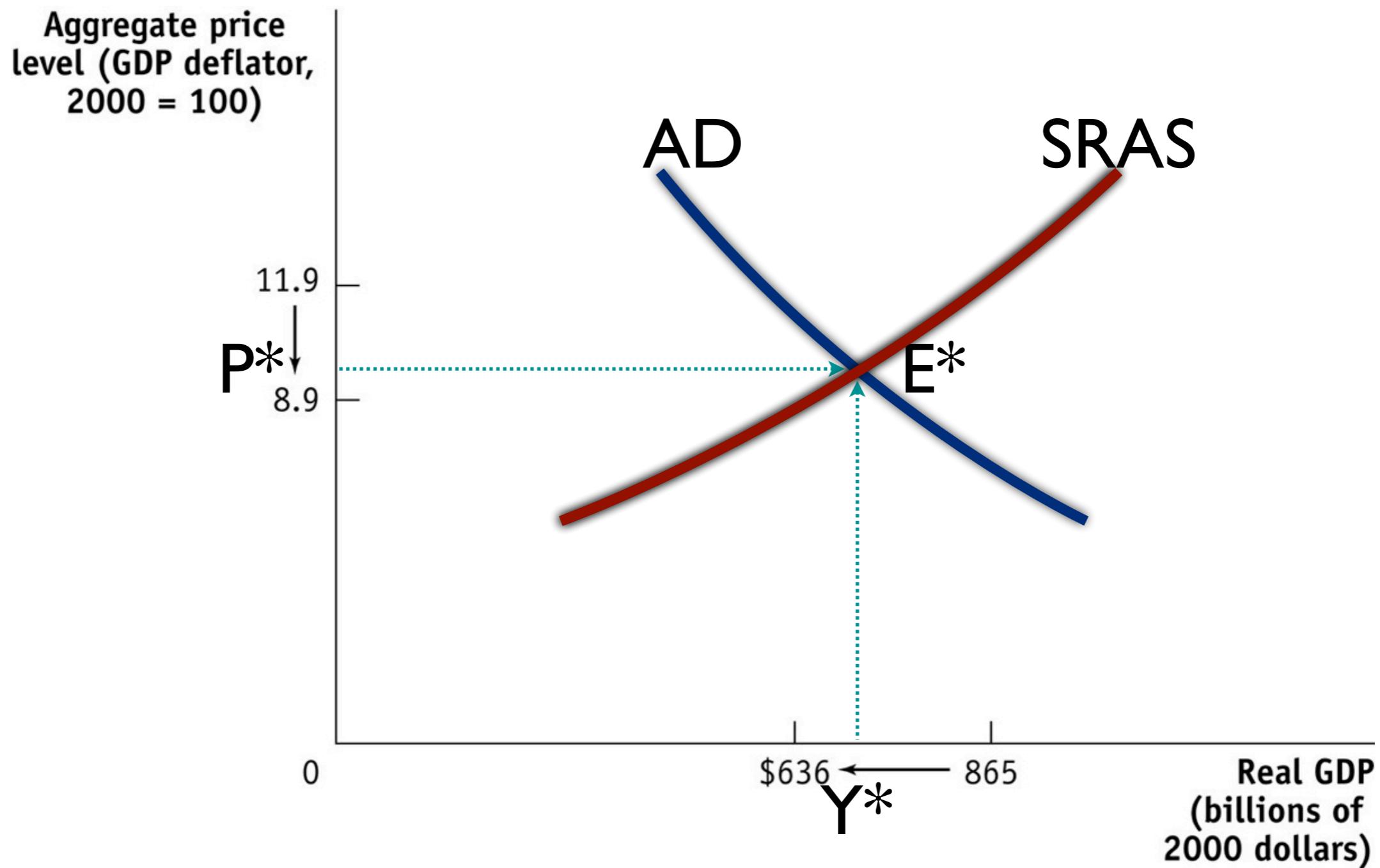
# Stagflation

- $Y_n$  하락
  - $r_n$  상승, PC 상승
  - 중앙은행은 이 상황에서 기준금리를 유지할 경우 인플레이션이 가속화됨
- 캡은 장시간동안 변화된 natural rate로 복귀하여 사라짐
  - 이 과정에서 인플레이션 증가: Stagflation
- 전통적 해석: Negative AS shock

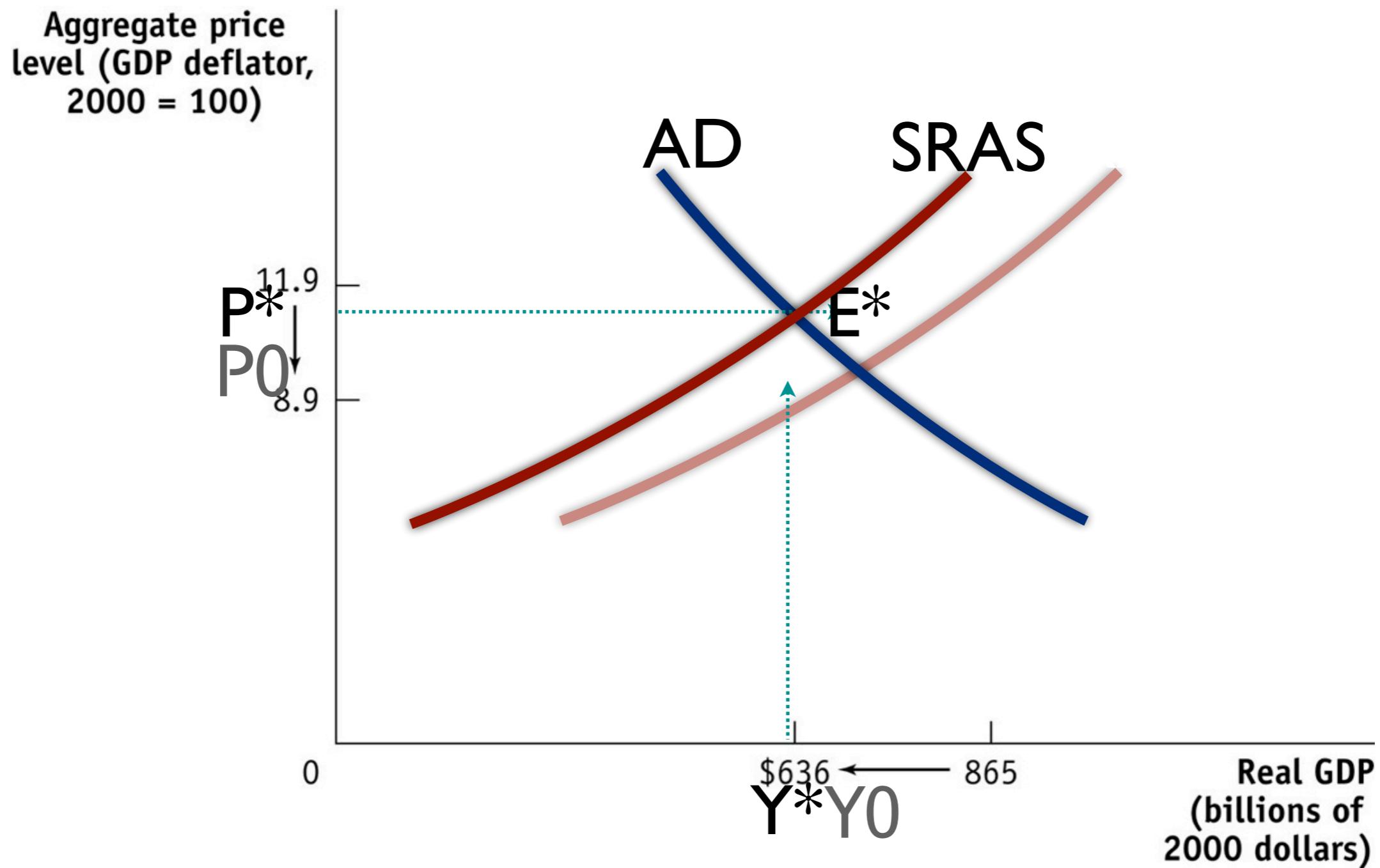


# 전통적 해석: Negative AS shock

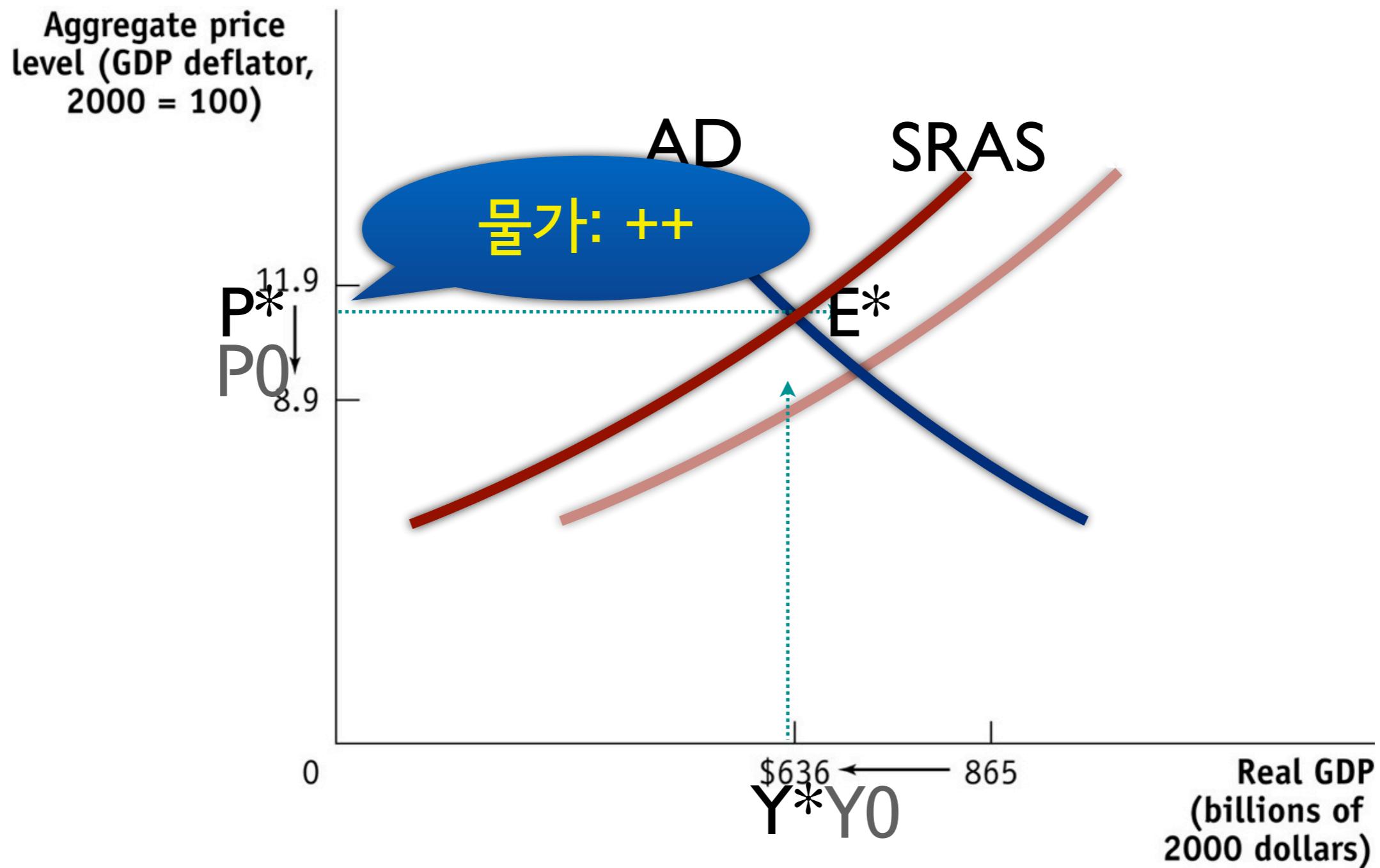
# 전통적 해석: Negative AS shock



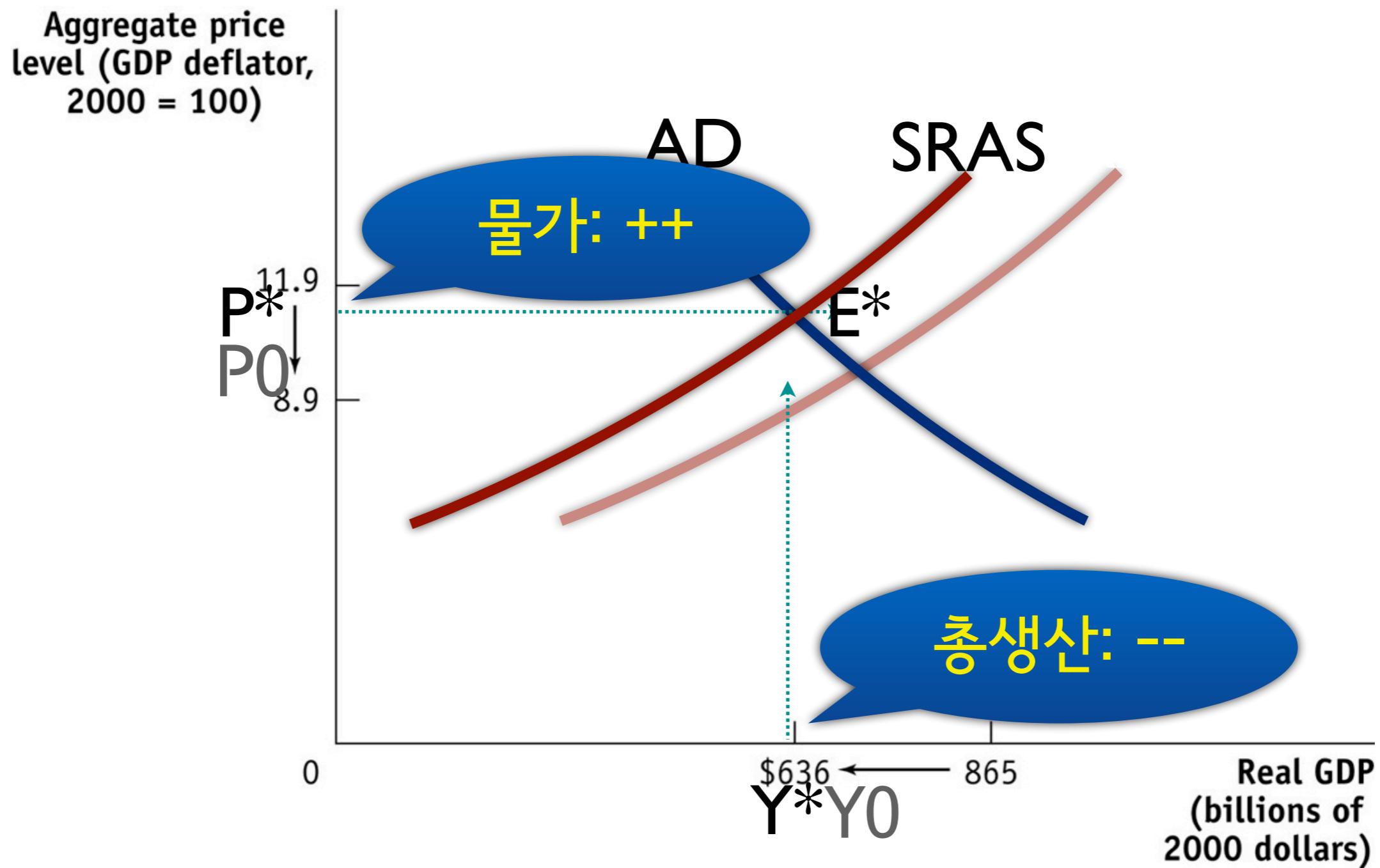
# 전통적 해석: Negative AS shock



# 전통적 해석: Negative AS shock



# 전통적 해석: Negative AS shock



# 유가상승 Case Study

- 1970년대: Stagflation 유발
  - 강한 물가상승
  - 강한 경기하강
- 2000년대: 유가상승의 효과가 훨씬 약했음

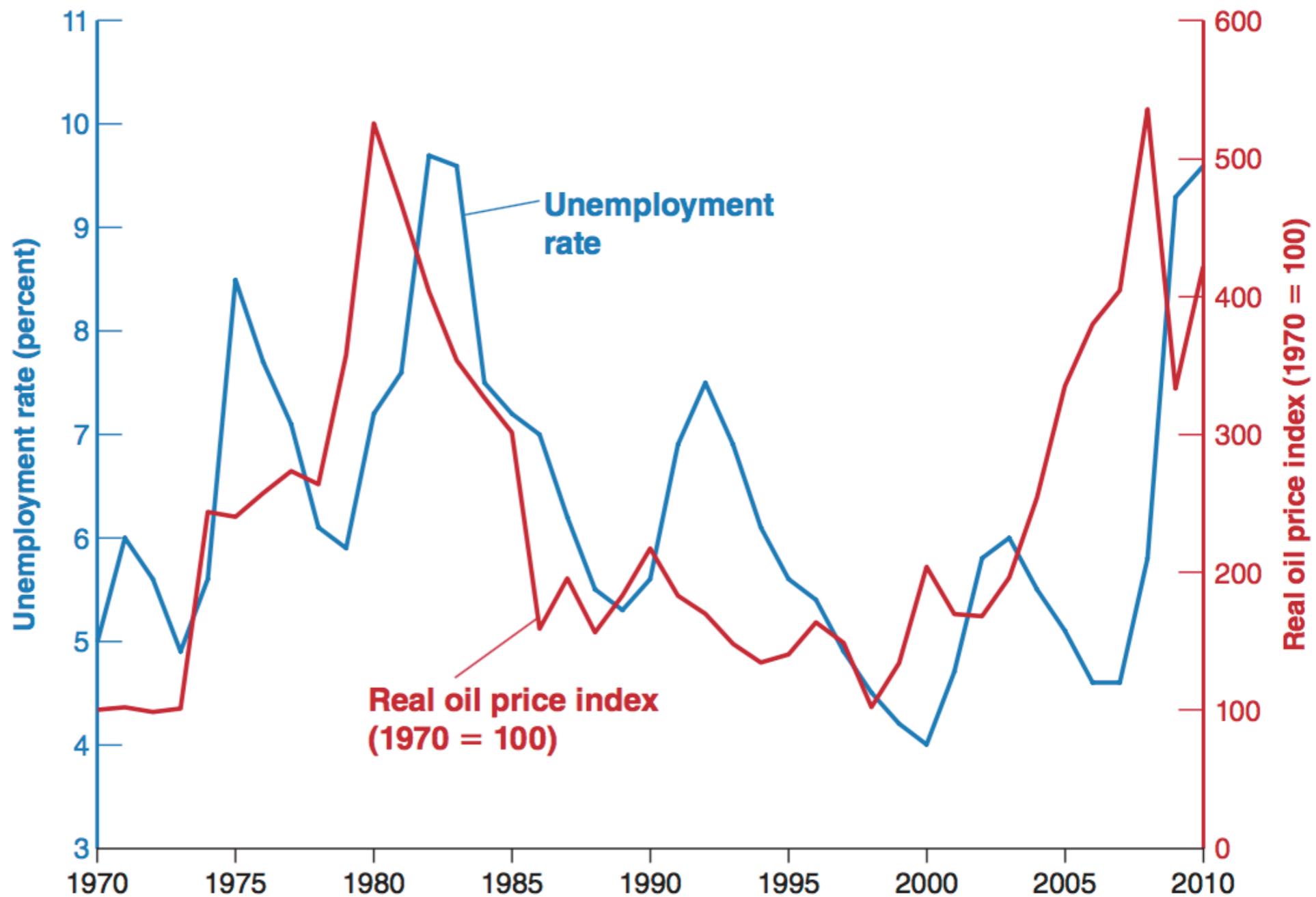
# 1970s versus 2000s

**Figure 7-15**

## *Oil Price Increases and Unemployment in the United States since 1970*

The oil price increases of the 1970s were associated with large increases in unemployment. This was however not the case in the 2000s.

Source: Real Oil Price Index—see Figure 7-11. Unemployment rate Series UNRATE: Federal Reserve Economic Data (FRED) <http://research.stlouisfed.org/fred2/>



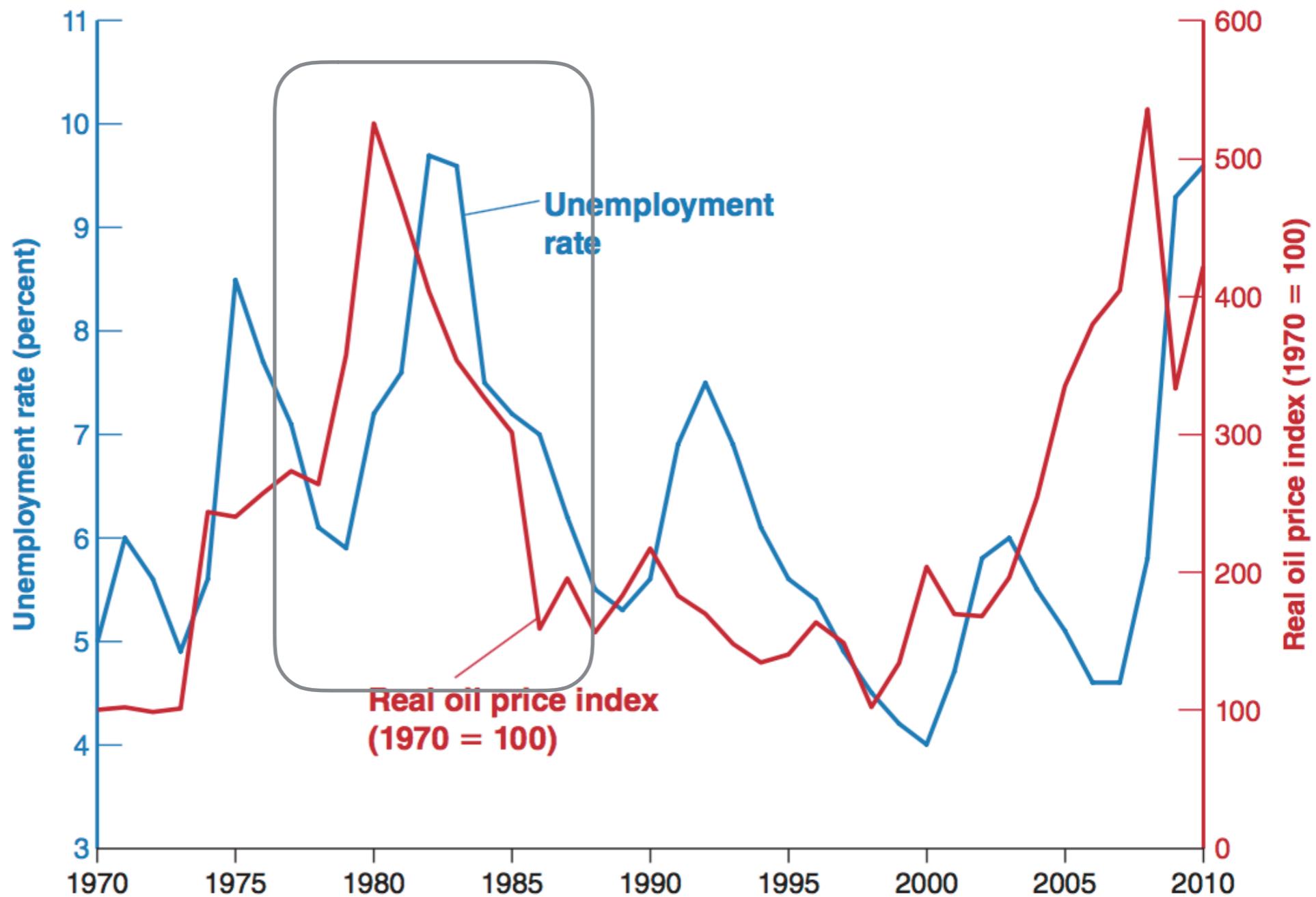
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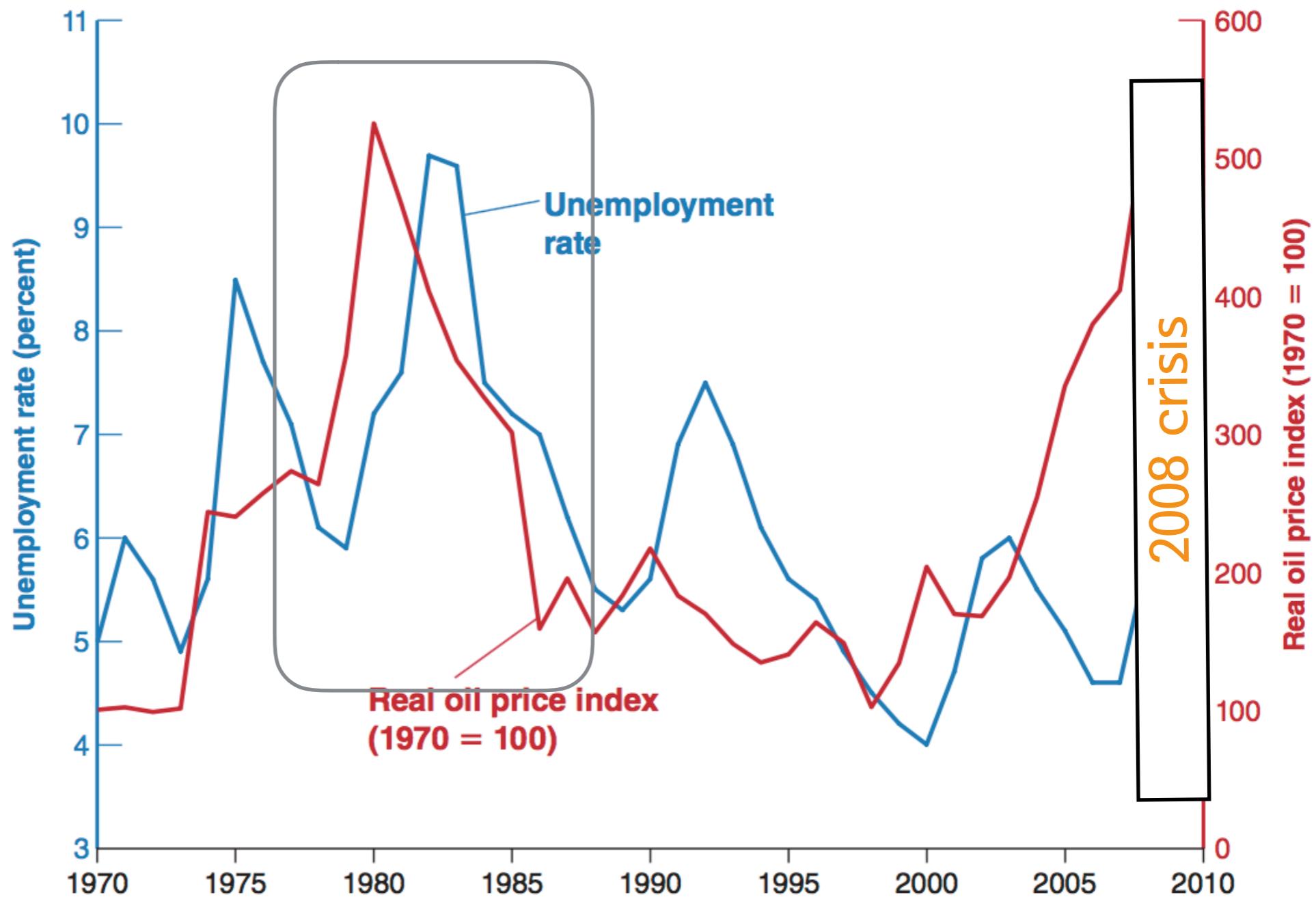
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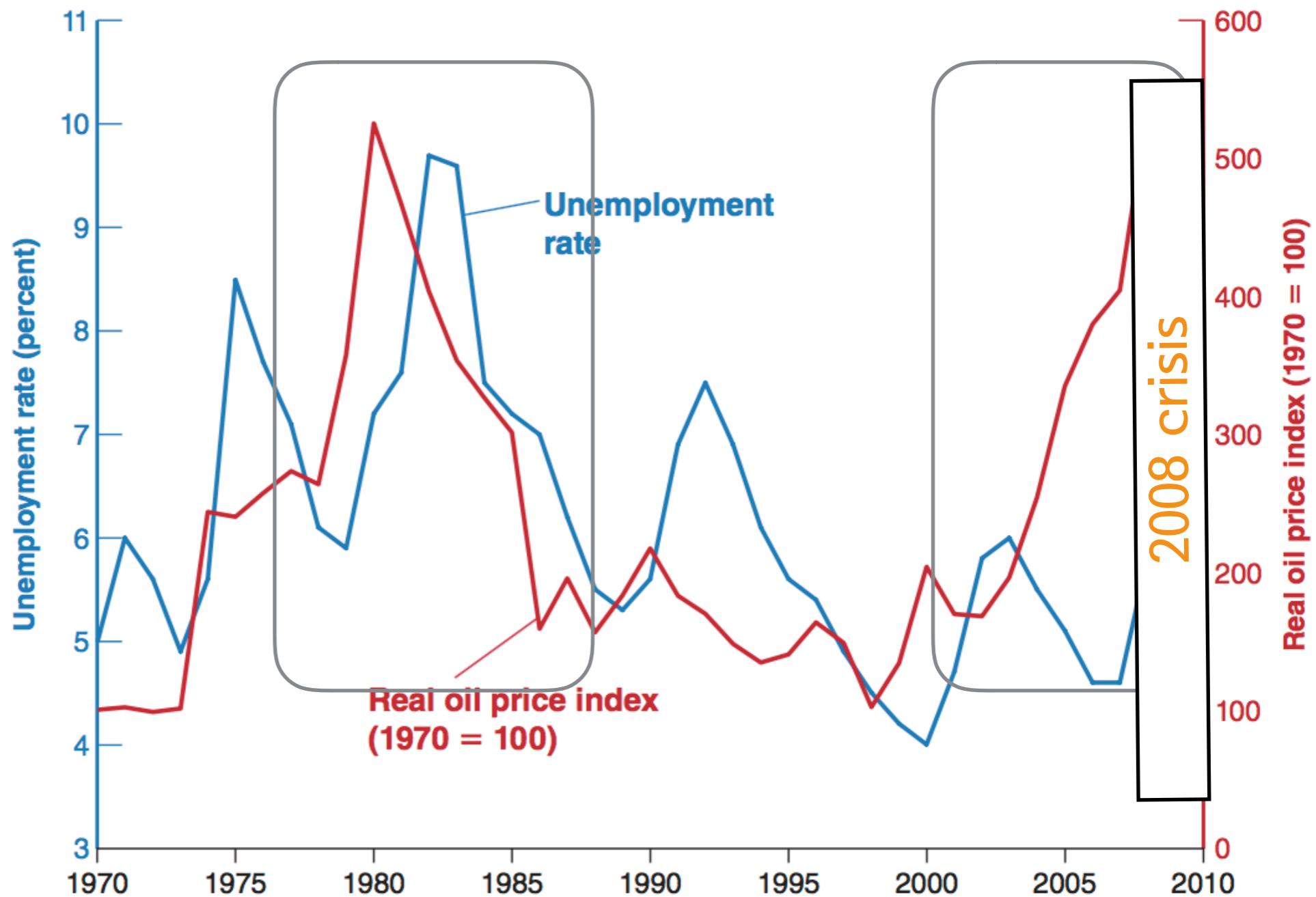
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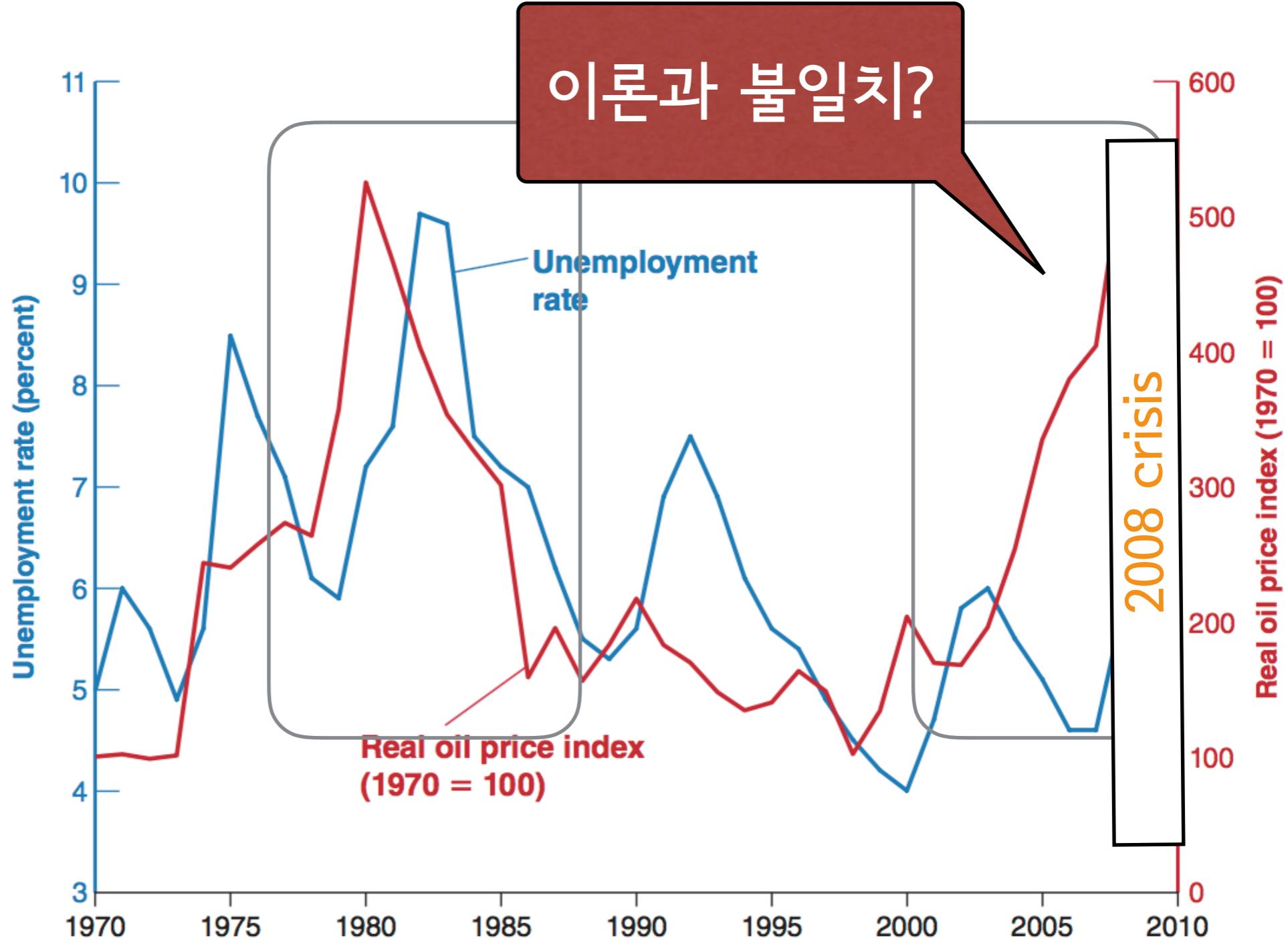
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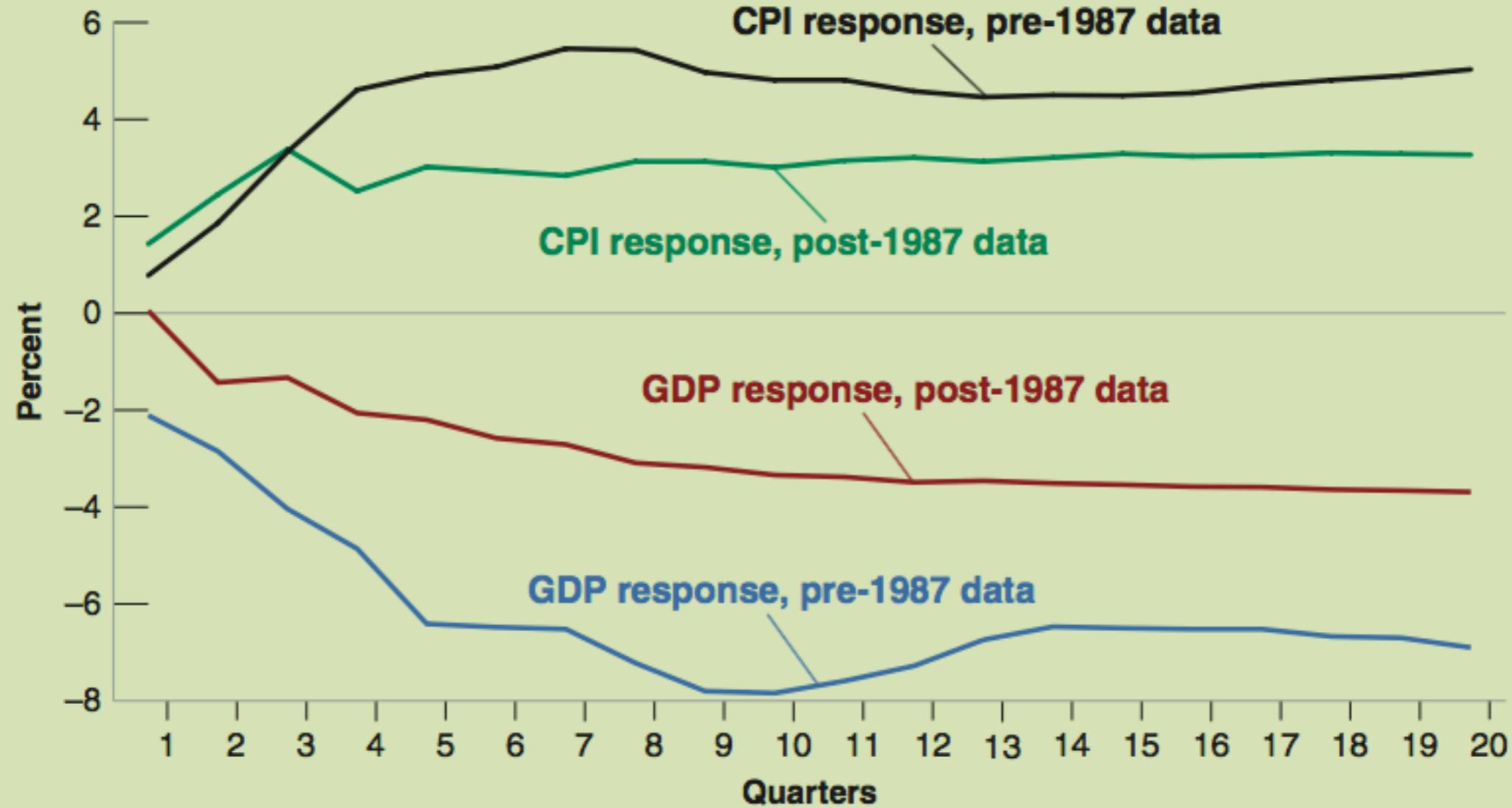
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# 1970s versus 2000s



**Figure 1** *The Effects of a 100% Permanent Increase in the Price of Oil on the CPI and on GDP*

# 설명 가설들

- 아직 완전한 합의에 도달하지 못한 주제
- 가설1: 노동자들의 협상력이 약해졌다
  - 유가 상승에 임금 하락으로 물가 영향 상쇄 - 자연실업률 증가 효과 감소
- 가설2: 통화정책의 효과가 달랐다
  - 1970년대: 기대인플레이션이 적응적  $\Rightarrow$  통화정책 효과 제한적
  - 2000년대: 기대인플레이션이 상수  $\Rightarrow$  통화정책 효과가 강함

# 다양한 충격들

- 1970년대(2건): Oil Shock (공급측 충격)
- 1980초: Disinflation (수요측 (G) 충격)
- 1990년초: 소비자 신뢰 감소 (수요측 (C) 충격)
- 2001: 닷컴버블 붕괴 (수요측 (I) 충격)
- 2008: 신용 충격 (수요측 (I) 충격)

# 다음 주제들

- 장기 경제성장
- 저축, 자본축적과 장기 경제 성장

# 수고하셨습니다!